

Indigent Criminal Defense Advanced Skills for the Experienced Practitioner

Presented by

The Chief Justice and Justices of the Supreme Court of Virginia
Members of the Chief Justice's Indigent Defense Training Initiative
and the
Virginia State Bar

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THE HONORABLE LEROY ROUNTREE HASSELL, SR.

Chief Justice Leroy Rountree Hassell, Sr. was appointed to the Supreme Court of Virginia in 1989 by then-Governor Gerald Baliles. Chief Justice Hassell was elected to the Supreme Court of Virginia by the General Assembly in 1990 and reelected in 2002. He was elected by his peers to serve as Chief Justice for a four-year term that began on February 1, 2003. He is the first black Chief Justice of the Supreme Court of Virginia, which is the oldest Supreme Court in the United States. As Chief Justice of the Supreme Court of Virginia, he is the chief administrative officer for the judiciary of the Commonwealth of Virginia.

Chief Justice Hassell graduated from the Norview High School in 1977. While in high school, he won numerous state and national debate tournaments, numerous public speaking awards, and he received the Outstanding Tidewater Student Award. He attended the University of Virginia and received a Bachelor of Arts degree in Government and Foreign Affairs. He was a member of the Dean's List every semester, and he was selected to live on the Lawn in recognition of his outstanding contributions to the University community. He attended the Harvard Law School where he was treasurer of the Harvard Black Law Students Association, and he was listed in the Outstanding Young Men of America.

In 1980, he joined the law firm of McGuireWoods. He had a general practice, and he represented many Fortune 100 and 500 corporations. He was elected to the partnership at McGuireWoods in seven years, one year earlier than the eight-year requirement. While a partner at McGuireWoods, he was a member of numerous corporate, civic, and charitable boards of directors including the Massey Cancer Center, Richmond Renaissance, Inc., the American Red Cross, the Garfield Childs Fund, Carpenter Center for the Performing Arts, St. John's Hospital, and Legal Aid of Central Virginia. He is also a former chairman of the Richmond School Board.

Chief Justice Hassell was born in Norfolk, Virginia on August 17, 1955. He is married to Linda Greene Hassell. He and his wife have three children. He is the son of Ruth Rountree Hassell and Joseph R. Hassell, Sr. His parents were educators in the Norfolk and Virginia Beach Public Schools.

Chief Justice Hassell is a volunteer with the public schools in Richmond. He is an adopter for the J.E.B. Stuart Elementary School and the J.L. Frances Elementary School. He has served as a hospice volunteer. He is also an usher at his church.

THE HONORABLE WALTER S. FELTON, JR.

Judge Felton, a native of Suffolk, Virginia, obtained a B.A. in English Literature from the University of Richmond, where he was inducted into Phi Beta Kappa and Omicron Delta Kappa. He received his J.D. degree in 1969 from the University of Richmond School of Law, where he was the Chancellor of the McNeil Law Society and Articles Editor of the University of *Richmond Law Review*. Following his graduation from law school, he served for four years as a Captain in the U.S. Army Judge Advocate General's Corps.

After his military service, he engaged in the private practice of law until July 1982, when he was appointed to the faculty of the Marshall-Wythe School of Law at the College of William & Mary in Virginia, and as Administrator of the Commonwealth's Attorneys' Services and Training Council. In January 1994, he was appointed Deputy Attorney General of Virginia, heading the Intergovernmental Affairs Division, and in July 1995 was appointed Senior Counsel to the Attorney General, serving in that capacity until January 1999. From September 1999 until January 2002, he served as Counselor to the Governor of Virginia and Director of Policy. In 2000, he was named the A.L. Philpott Distinguished Adjunct Professor of Law at the University of Richmond School of Law, where he taught "Law, Politics, and Public Policy."

In January 2002, he returned to the William & Mary Law School faculty and was appointed Legislative Counsel for the College. He was elected by the General Assembly as a Judge of the Court of Appeals of Virginia, and has served on that bench since September 2002.

Judge Felton resides in Williamsburg, Virginia and continues to teach Trial Advocacy at the William & Mary Law School as an adjunct professor of law.

STEVEN D. BENJAMIN

Steve Benjamin is a criminal defense lawyer with the Richmond firm of Benjamin & DesPortes. He serves as Special Counsel to the Virginia Senate Courts of Justice Committee and the Virginia State Crime Commission. He is a member of the Virginia Indigent Defense Commission, has served on numerous state legislative committees, is an Adjunct Professor of Law in Scientific Evidence at the University of Richmond, and serves on the Advisory Board of the Innocence Commission of Virginia.

He is a Fellow of the American Board of Criminal Lawyers, a member of the Board of Directors of the National Association of Criminal Defense Lawyers, and the immediate Past President of the Virginia Association of Criminal Defense Lawyers. He is a frequent CLE lecturer on criminal justice and defense issues. He has given presentations nationally and throughout Virginia, including presentations to the American Bar Association, American Academy of Forensic Sciences, National Association of Criminal Defense Lawyers, National Legal Aid and Defender Association, Virginia State Bar, The Virginia Bar Association, The Commonwealth's Attorneys' Institute, and The Judicial Conference of Virginia.

In 1996, he was counsel in Virginia's landmark case on the appointment of experts, *Husske v. Commonwealth*. In 1998, he argued through Virginia's courts and on petition to the United States Supreme Court that Virginia's unwaivable fee caps on compensation for court-appointed counsel deprived indigent defendants of conflict-free representation. In 2001, he won the exoneration and release of Jeff Cox, a man who served 11 years of a life sentence for a murder he did not commit. In 2003, he argued for the free speech rights of public housing residents in the United States Supreme Court (*Virginia v. Hicks*). In 2003, he was presented the Virginia State Bar's Lewis F. Powell Pro Bono Award in recognition of his years of indigent defense and efforts toward indigent defense reform.

STEPHEN B. BRIGHT

Stephen B. Bright has been the Director of the Southern Center for Human Rights in Atlanta since 1982, and has taught a course on the death penalty at Yale Law School since 1994. He has represented people facing the death penalty at trials and on appeals and prisoners in challenges to inhumane conditions and practices. He has written articles and book chapters on criminal justice, human rights of prisoners, and judicial independence. He has testified before committees of both the U.S. Senate and House of Representatives. His work and that of the Center have been featured in two books, *Proximity to Death* by William McFeely (Norton 1999) and *Finding Life on Death Row* by Kayta Lezin (Northeastern University Press 1999). He received the American Bar Association's Thurgood Marshall Award in 1998.

DAVID I. BRUCK

David Bruck is a Clinical Professor of Law at Washington & Lee University School of Law. He has served as one of four part-time Federal Death Penalty Resource Counsel to the federal defender system nationwide since 1992. He is a graduate of Harvard College and the University of South Carolina School of Law. He has practiced criminal law since 1976, and has specialized in the defense of capital cases since 1980. Bruck has served as a county and state public defender in South Carolina, and has represented capital defendants at trial in some 20 cases, including *South Carolina v. Susan Smith* (1994-1995). He has argued seven death penalty cases in the United States Supreme Court, including *Skipper v. South Carolina*, 476 U.S.1 (1986), *Simmons v. South Carolina*, 512 U.S. 154 (1994), and *Kelly v. South Carolina*, 534 U.S. 246 (2002), and has handled more than 60 capital appeals in state and lower federal courts.

Bruck has testified before U.S. Congressional committees on death penalty legislation on seven occasions, and has lectured to lawyers, judges and mental health professionals on capital sentencing issues in more than 30 states and U.S. territories.

Bruck received the John Minor Wisdom Public Service & Professionalism Award from the ABA Section of Litigation in 1996, and the Significant Contributions to Criminal Justice Award from California Attorneys for Criminal Justice in 2001. He has taught seminars on the law of capital punishment at the University of South Carolina School of Law, was the 1990 Ralph E. Shikes Visiting Fellow at Harvard Law School and, in 2002, served as Scholar in Residence at the Frances Lewis Law Center, Washington & Lee University, in Lexington, Virginia. Since mid-2004, Bruck has directed W&L's Virginia Capital Case Clearinghouse. The Clearinghouse serves as a support function for lawyers defending capital-charged clients throughout Virginia, and publishes the *Capital Defense Journal*.

JOHN G. DOUGLASS

John Douglass is a Professor of Law at the University of Richmond, where he teaches Criminal Law and Criminal Procedure and manages a program in litigation skills and trial advocacy. His principal academic publications have focused on the criminal trial process and the Confrontation Clause.

He received a B.A. in history *summa cum laude* from Dartmouth College and a J.D. *magna cum laude* from Harvard Law School where he served as Editor of the *Harvard Law Review*. Before joining the University of Richmond law faculty in 1996, Professor Douglass was an Assistant United States Attorney in Baltimore and Richmond. In Richmond, he served as Chief of the Criminal Division.

Professor Douglass also served on the staff of Independent Counsel Lawrence Walsh in the Iran-Contra investigation. As a partner in a Richmond law firm, he specialized in commercial litigation, insurance defense, construction litigation, and white-collar criminal defense. Professor Douglass is a faculty member of the Virginia State Bar's Course on Professionalism, an instructor in trial advocacy and other litigation skills for the National Institute for Trial Advocacy, and a frequent lecturer at continuing legal education programs. He also serves as a mediator of commercial disputes through The McCammon Group.

GREGORY E. LUCYK

Greg Lucyk is the Chief Staff Attorney for the Supreme Court of Virginia. In addition to assisting the Court with Special Projects, reviewing legislation, and drafting proposed rules, he supervises 10 staff attorneys who assist the Justices in reviewing and processing some 3,000 petitions for appeal and original jurisdiction cases annually.

Greg has been a licensed attorney in public service since 1976. He has argued in the Supreme Court of the United States, appeared dozens of times to argue appeals in the Supreme Court of Virginia and the federal courts of appeals, and has litigated hundreds of cases at the state and federal trial court levels.

Before joining the Supreme Court in 2002, Greg served for nearly 18 years in the Office of the Attorney General of Virginia, including eight years as Section Chief of the Trial Section. He supervised a staff of 18 while serving as lead litigation counsel on office-wide complex trial teams, and carried his own extensive trial and appellate caseload. Before the joining AG's office, Greg spent

five years as a Program Director and Managing Attorney at the Virginia Poverty Law Center in Richmond, Virginia, where he provided lead counsel assistance and supervised the advocacy efforts of state and local legal services programs for low-income Virginians.

Greg graduated from the Temple University School of Law in 1976, where he was Managing Editor of the *Temple Law Review*. Upon graduation, he served a one-year term as a Law Clerk in the Supreme Court of Pennsylvania, in the chambers of The Honorable Robert N.C. Nix, Jr., Associate Justice.

PAMELA R. MACKEY

Pamela Mackey, best known for her defense of Kobe Bryant, practices criminal defense and complex civil litigation as a shareholder at Haddon, Morgan, Mueller, Jordan, Mackey & Foreman, P.C., in Denver, Colorado. She served as a Deputy State Public Defender in the Colorado Public Defender's Office during the years 1989-1994, was graduated with highest honors from the George Washington University Law School, where she was the Executive Editor of the *George Washington University Law Review*, and received her B.S. with honors in Journalism from The University of Colorado at Boulder.

She is a member of the American College of Trial Lawyers, is listed in the *Best Lawyers in America*, and in 2003, was selected by her peers as the Best of the Bar in Colorado for individual Criminal Defense. She is currently the chair of the Criminal Justice Act Standing committee, a member of the 10th Circuit Court of Appeals criminal pattern jury instruction committee, a member of the DBA Conciliation Panel and Regional Co-Chair of the ABA Committee on White-Collar Crime. She is a past-president of the Colorado Women's Bar Association. She regularly speaks and publishes in the area of criminal defense

RANDI MCGINN

Randi McGinn is a dynamic trial lawyer and member of the New Mexico Bar whose creative courtroom techniques have consistently made her a top-ranked speaker. She is listed in *Best Lawyers in America* for her expertise in both criminal and civil litigation. She is a Fellow of the American Board of Criminal Lawyers, a Past President of the New Mexico Trial Lawyers' Association, and a member of the Board of Directors of the National Association of Criminal Defense Lawyers. McGinn has taught trial skills for more than a decade with the National Institute for Trial Advocacy (NITA), the National Criminal Defense College (NCDC), and as an Adjunct Professor at the University of New Mexico School of Law. Her relentless push to protect individual rights has led her to represent diverse clients, including members of several motorcycle clubs. She has published "*Women: Taking Arms Against Crime*" in the *American Rifleman*.

Her use of demonstrative evidence is of legendary proportions. She has destroyed adverse witnesses in such memorable style as leaving a pretentious Beverly Hills doctor standing in front of the jury covered with post-its and clutching a grapefruit to his chest; grilling a deceitful informant until he was physically ill; and exposing the fact that a world-renowned polygraph expert had been polygraphing his own biological evidence in the dead of night.

WILLIAM C. THOMPSON

William C. Thompson is a professor in the Department of Criminology, Law & Society at the University of California, Irvine (UCI). He is also a member of the California Bar. He received a Ph.D. in Psychology from Stanford University, where his studies focused on sources of human error in scientific and statistical inference. He received a J.D. from the University of California's Boalt Hall School of Law. He has been studying and writing about forensic DNA evidence since 1988. The 25 articles he has published on the subject have appeared in scientific journals such as *Genetica* and the *Journal of Forensic Sciences*, as well as legal publications.

He has participated, as co-counsel for the defendant, in six criminal trials involving forensic DNA evidence. He has also assisted a number of convicted individuals in obtaining post-conviction DNA testing. He served as Reporter for the American Bar Association Standards Committee Study Group on DNA Evidence, and currently serves on the ABA Task Force on Biological Evidence. He currently co-chairs the NACDL Forensic Evidence Committee.

He has worked as a consultant to police departments, a coroner and lawyers on a variety of cases involving biological evidence in the US, the United Kingdom and Australia. Thompson has also been active in efforts to investigate fraud, misconduct and poor scientific practices in forensic laboratories. His review of DNA testing at the Houston Police Department Crime Laboratory uncovered a number of serious errors, including the error that caused the false rape conviction of a Houston man, Josiah Sutton. Sutton was released last year when additional DNA testing proved his innocence.

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RANDI MCGINN

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JOHN G. DOUGLASS

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CHAPTER I:

HUSSKE AND SANCHEZ: **INVOKING THE** **CONSTITUTIONAL RIGHT** **TO EXPERT ASSISTANCE** **AT STATE EXPENSE**

By

Steven D. Benjamin
Betty Layne DesPortes

**HUSSKE AND SANCHEZ: INVOKING THE CONSTITUTIONAL RIGHT
TO EXPERT ASSISTANCE AT STATE EXPENSE**

Steven D. Benjamin
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I. GENERAL PRELIMINARY CONSIDERATIONS

A. The Role of Experts in Criminal Defense

1. Comprehension. Expert assistance is helpful in understanding the nature, significance, and limitations of anticipated evidence. An expert can help the attorney assess the reliability of scientific testing, examination, and results, and can suggest other or more reliable scientific investigations.
2. Confrontation. An expert can assist an attorney in identifying the facts and issues that should be raised in cross-examination.
3. Testimony. An expert can assist an attorney in the presentation of relevant evidence helpful to the defense.

B. General Tests of Admissibility

1. Frye General Acceptance Test: The principle or discovery from which a deduction is made must be sufficiently established to have gained general acceptance in that particular field.
 - a. Principle
 - b. Technique or methodology (used to apply principle to evidential facts)
 - c. Was the technique properly applied in this case?
2. Federal Rule of Evidence 702

Daubert v. Merrill Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993): Supreme Court recognized that science can be both powerful and misleading. Affirmed the “gatekeeping” role of federal district courts in making the determination of reliability crucial to admissibility. In order to guide the courts in this role, suggested consideration of several factors to determine whether

the reasoning or methodology underlying the proposed testimony is scientifically valid:

- a. Publication
 - b. Peer review
 - c. Error rate
 - d. General acceptance
 - e. Is the testimony relevant to a material issue?
 - f. Not exhaustive: standard is flexible
3. Obtaining the Ruling on Admissibility
- a. when: pretrial
 - b. how: motion in limine or to exclude
 - c. why: require proponent to prove scientific validity of principle of technique underlying anticipated testimony
 - d. who: opponent must show that the proposed testimony or evidence fails admissibility standard of reliability.
4. Consider saving weight questions for trial

C. Subjects which have passed *Daubert* analysis

1. Drug analysis
2. Intoxilyzer results
3. Photogrammetry
4. DNA: RFLP, PCR, STR

D. Subjects which have failed *Daubert* analysis

1. Psychiatric testimony re: problems in eyewitness ID
2. Voice comparison techniques
3. Hair comparison

4. Polygraph
5. Brain fingerprinting

E. Illustrative Virginia Cases

1. *Zelenak v. Commonwealth*, 25 Va. App. 295, 487 S.E.2d 873 (1997). Defendant had asserted a defense of duress - that her acts were the product of threats inducing a reasonable fear of immediate death or serious bodily injury. The defendant had proffered the testimony of a psychologist that she suffered from a disorder making her “susceptible to duress.” She contended that she was so afraid of a third party that she believed she would be harmed unless she did what he said, and that escape or disobedience would result in death.

The Court of Appeals affirmed the trial court’s ruling prohibiting this testimony. The testimony expressed an opinion on an ultimate issue. The trial court had no duty to cull the relevant and probative portions of the proffered testimony from the inadmissible portions.

2. *Downing v. Commonwealth*, 26 Va. App. 717 (1998)(Denial of neurologist affirmed because pathological intoxication defense not recognized under Virginia law)
3. *Peebles v. Commonwealth* (1998)
4. *Utz v. Commonwealth* (1998) (gang expert)

F. Preserving issues for appeal

1. Must object
2. With specificity
3. Cite federal constitutional grounds whenever possible
4. Make any necessary showing and proffer
5. Be prepared to all of this in detail, ad nauseam

II. SOURCES OF EXPERT TESTIMONY AND INFORMATION

A. Crime Lab

1. The Virginia Department of Forensic Science operates the various regional forensic laboratories. While scientists are expected to retain their objectivity and strict adherence to the scientific method, these labs are maintained by a state agency completely dependant on the state budgetary process for its resources. The laboratory should be regarded as an arm of the prosecution. Due diligence will not permit defense counsel to accept laboratory results at face value; additional scrutiny will be necessary:
 - a. Assume a pro-law enforcement/anti-defendant bias exists
 - b. Assume that your questions and statements are shared with the prosecution
 - c. Do not assume all possible tests have been done
 - d. Do not assume that all results have been disclosed
2. Always meet with the examiner
 - a. Read the report and any pertinent literature
 - b. Prepare your questions ahead of time
 - c. Question terms and findings you do not understand – you must understand everything in the report
 - d. Any tests or comparisons not reflected in the report?
 - e. Any other tests available? Were they requested?
 - f. Any photographs? Any drawings? Any computer printouts?
 - g. Where was the evidence sent next?
3. Obtaining the underlying examiner notes is essential to the evaluation of the reliability and accuracy of the examiner's work and conclusions.

B. Certificate of Analysis

1. Description
 - a. Identify the examiners
 - b. Findings and conclusions
 - c. Introduced in lieu of testimony
2. Evidentiary problems and potential objections
 - a. Hearsay. Must comply with Virginia statutory requirements.
 - b. Confrontation Clause. *Crawford v. Washington*, 124 S.Ct. 1354 (2004).
 - c. Chain of custody
 - d. Authentication
3. Admissibility: generally addressed by statute or the FRE or case law
4. Other information
 - a. Date of the report
 - b. Date of receipt of evidence
 - c. Person submitting the evidence
 - d. Suspect
 - e. Evidence submitted

C. Experts

1. Practical and strategic concerns
 - a. Do you want the testimony/findings emphasized?
 - (1) Demonstrative evidence: people remember what they see more than what they hear

- (2) If not, stipulate the evidence.
 - b. Only put on what is essential.
 - c. Be prepared to explain absence of scientific evidence and efforts made to obtain (CSI Factor)
 - d. Type of expert: university engineering professor v. railroad worker
 - e. Avoid the mercenaries – they will always fold on cross
2. Finding the expert
- a. Government: usually available as government employee
 - b. Defense:
 - (1) Universities, colleges
 - (2) Professional publications
 - (3) Other experts
 - (4) Other lawyers
 - (5) Specialty bar associations (NACDL, VACDL, VTLA)
3. Funding
- a. Constitutional grounds: due process, equal protection, effective assistance of counsel, compulsory process, confrontation

The fundamental fairness required by due process means that indigent defendants must be provided with “an adequate opportunity to present their claims fairly within the adversary system.” *Ross v. Moffitt*, 417 U.S. 600, 612 (1974). This goal is implemented by the identification of the “basic tools of an adequate defense. *Britt v. North Carolina*, 404 U.S. 226, 227 (1971). *Ake v. Oklahoma*, 470 U.S. 68 (1985) *Caldwell v. Mississippi*, 472 U.S. 320 (1985)

Husske v. Commonwealth, 252 Va. 203, 476 S.E.2d 920 (1996)
Commonwealth v. Sanchez, 268 Va. 161, 597 S.E.2d 1967 (2004)

- b. Statutory:
 - 1. 18 U.S.C. §3006A(e)(1)
 - 2. Va. Code §9.1-121

III. THE LAW IN VIRGINIA

The fundamental problem was that for many years, defendants had requested the appointment of experts on the basis of the holding in *Ake v. Oklahoma*. The Virginia Supreme Court had always articulated a very limited interpretation of *Ake*. For example, in *O'Dell v. Commonwealth*, 234 Va. 672, 364 S.E.2d 491 (1988), the defense had sought the assistance of various forensic experts. Without considering whether the defendant had made an adequate showing of need, the Court stated:

“O’Dell admits that none of the proposed experts would address the question of his sanity, as in *Ake v. Oklahoma*; they were all forensic scientists. O’Dell had no constitutional right requiring the Commonwealth to provide funding of this type of expert assistance.”

In *Husske*, our approach, with respect to the applicable law, was to argue that *Ake* was not limited to the provision of psychiatric assistance and capital murder. We argued that *Ake* was but part of the process of identifying the basic tools of an adequate defense, and that the issue had been expressly left open in *Caldwell*. We pointed out that the Virginia Supreme Court, since *Ake* had continued that case-by-case process of identifying basic tools, resulting in a series of holdings as to what was not required. An important facet of that analysis was one often overlooked from the *Ake* decision – that the determination was not static. Indeed, *Ake* had emphasized the need for a flexible standard. Accordingly, we argued that the same standard which recognized the emergence of an increased role of psychiatry in the courtroom should recognize the sudden and extraordinary emergence of forensic DNA application.

The Court accepted this reasoning in *Husske*:

“Contrary to the Commonwealth’s arguments, we have not specifically held that *Ake* is implicated only in those cases where the defendant’s sanity at the time he committed an offense is seriously in question.”

“We are of opinion that *Ake* and *Caldwell*, when read together, require that the Commonwealth of Virginia, upon request, provide indigent defendants with “the basic tools of an adequate defense,” and, that in certain

instances, these basic tools may include the appointment of non-psychiatric experts.”

IV. THE SHOWING

- A. Ake: State must provide access to psychiatric assistance when sanity is to be a “significant factor” at trial.
- B. Caldwell: The defendant’s request was properly denied because the defendant failed to show the reasonableness of the request, or the necessity of the experts. Instead, the defendant had offered “little more than undeveloped assertions that the requested assistance would be beneficial.”
- C. Question left open in Caldwell: What, if any, showing would entitle a defendant to non-psychiatric assistance as a matter of federal constitutional law?
- D. Tests
 - 1. Presumed Need/Reasonable Necessity
 - a. In *Ake*, the defendant’s need was “readily apparent” where sanity was “likely to be a significant factor in his defense.”
 - b. Advantage of *Ake* test:
 - (1) All the defendant must establish is that a certain issue will be a significant factor at trial.
 - (2) Prejudice is presumed
 - c. This test is consistent with the Fourth Circuit’s pre-*Ake* standard for resolving equal protection requests:
 - (1) “An indigent prisoner who needs expert assistance because the subject matter is beyond the comprehension of laymen should not be required to present proof of what an expert would say.”
 - (2) “The obligation arises when a substantial question exists over an issue requiring expert testimony for its resolution and the defendant’s position cannot be fully developed without professional assistance.”

2. Significant Factor “Plus”
 - a. Proffer of specific need
 - b. Proffer of the testimony which would be adduced
 - c. Showing that a denial of the requested assistance would affect the outcome of the trial.
 - d. Problems:
 - (1) Indigent defendants are faced with the Catch-22 of needing expert assistance to demonstrate the need for expert assistance and the prejudice that would result from denial.
 - (2) Requirement of predetermination: Merits of a case should not be predetermined in a proceeding where the defendant has no opportunity to meaningfully participate, *Douglas v. California*, 372 U.S. 353 (1963)(the provision of counsel for purposes of appeal should not be dependent upon a court’s assessment of the probable merits of the appeal).
3. *Husske*: Most burdensome test
 - a. Subject which necessitates the assistance of the expert is likely to be a significant factor in his defense, and
 - b. Defendant will be prejudiced by the lack of expert assistance
 - (1) the services of an expert would materially assist him in the preparation of his defense, and
 - (2) the denial of such services would result in a fundamentally unfair trial.
4. *Husske*’s failure
 - a. No prejudice
 - b. Impossible: “Indeed, he could not make such a showing because. . . he confessed to the crimes, and he described the details of his offenses with great specificity.”

- c. No particular need
- d. Reality (Senior Justice Poff)
 - (1) Five threshold motions which explained in increasing and cumulative detail why and in what respects Husske's counsel needed DNA assistance
 - (2) Renewal of motion and proffer
 - (a) challenged laboratory methodology
 - (b) questioned validity of conclusions
 - (c) flatly contradicted the Comm.'s experts

V. POST-HUSSKE

A. Entitlement

- 1. Judicial grace
- 2. Capital cases
- 3. Psychiatric assistance
- 4. Constitutional

- B. *Bailey v. Commonwealth*, 259 Va. 723, 529 S.E.2d 570 (2000). Defendant's request for the appointment of an investigator fell "far short of demonstrating a particularized need for the services of an expert."
- C. *Lenz v. Commonwealth*, 261 Va. 451, 544 S.E.2d 299, cert. denied, 534 U.S. 1003 (2001). The defendant had sought the appointment of an expert on prison operations and classification to assist in presenting evidence of prison life. The Virginia Supreme Court found no abuse of discretion because the trial court's denial did not result in a fundamentally unfair trial. Nor was the defendant prejudiced by the denial, as he was able to adduce testimony from other witnesses on prison life.
- D. *Green v. Commonwealth*, 266 Va. 81, 580 S.E.2d 834 (2003). The defendant had sought the appointment of an investigator, citing counsel lack of investigative resources, training in criminal investigations, and

time to interview essential witnesses. The defendant proffered that the requested investigator “would have the expertise necessary to locate essential witnesses and data, examine and evaluate testimony and documents using his or her specialized knowledge of the issues likely to be significant at a capital murder trial, issues beyond the comprehension of the ordinary layman.” Id. at 840. The Court noted that Green’s proffer was “strikingly similar” to the reasons advanced unsuccessfully in Bailey (defendant proffered that an investigator was necessary to “locate essential witness and data, [and]examine and evaluate testimony and documents likely to be significant at a capital murder trial.”).

E. Commonwealth v. Sanchez, 268 Va. 161, 597 S.E.2d 1967 (2004).

In Sanchez, defense counsel had been allocated \$3,000 to obtain a pretrial DNA consultation. Shortly before trial, counsel sought additional funds, but his written motion failed to describe the DNA expert’s proposed testimony and did not allege that a denial of funds would be prejudicial to the defense. Confronted with the need for greater specificity, counsel offered to provide additional information ex parte. When that suggestion was rejected, counsel proffered that:

“we [had the expert] go over the [DNA] documents from the state laboratory. There are approximately - about four or five inches worth of documentation that he has reviewed. In that documentation, he has noticed that there were errors in the way that the DNA procedures were followed, that there were errors in the way the examination was done, which could have had significant impact in the results of the DNA. So therefore the DNA results that the commonwealth is going to put forward as being scientifically valid could be questioned, to an extent by our expert witness and therefore the Commonwealth’s only other evidence, other than the DNA, which we submit would not be evidence that is credible, would be testimony of one witness who had admittedly [been using] cocaine and drinking alcohol.”

The Court of Appeals found that counsel’s proffer was sufficient to demonstrate a particularized need, held that the denial of funds necessary for further assistance “adversely affected his ability to rebut and challenge the Commonwealth’s evidence,” and that the error was not harmless beyond a reasonable doubt. *Sanchez v. Commonwealth*, 41 Va. App. 319, 585 S.E.2d 331 (2003). The Commonwealth appealed, and the Virginia Supreme Court reversed the holding of the Court of Appeals.

The Court found that counsel’s proffer was inadequate. Instead of demonstrating the necessary particularized need, it offered only conclusory assertions. Consequently, “the trial court was left only to

guess whether the unknown, unexplained potential testimony of Sanchez' expert would be a significant or material factor in his defense and, consequently, whether the lack of that testimony would prejudice Sanchez." For example:

1. The proffer failed to specify the particular procedural defects uncovered by the defense expert, or how the state's expert was in error;
2. The trial court was unable to determine the materiality of the alleged errors. Neither the trial court nor the appellate court could determine, from the record, whether the errors affected the actual analysis, or had an insignificant affect on the calculation of probability.

In addition, having been allotted funds for pretrial consultation with the expert, the Court noted that the defendant "was in a far better position to advise the trial court of that expert's proposed testimony than a defendant seeking an expert in the first instance." The Court concluded that if the specific information necessary to the success of the request for additional funds existed, it was known to counsel and could have been provided. Counsel's inability or unwillingness to provide specifics was fatal to the claim of constitutional entitlement.

F. Meaning of Sanchez.

1. If there were any doubt, this decision is a clear statement of the rigor with which the Virginia Supreme Court will apply the requirements of *Husske*.
2. The defense proffer must be more than a hopeful suggestion that counsel is on to something. The proffer must clearly demonstrate a likelihood that the desired testimony would be significant and that prejudice would result from its denial.
3. For example, while the representations made in Sanchez made be sufficiently meaningful to a scientist or someone else with expertise in the field, the representations assumed too much knowledge on the part of the trial court.
4. The result in Sanchez may have been easier to reach because despite counsel having had an adequate opportunity for pretrial consultation, he was still only able to make vague assertions of improper procedures and no representations as to significance.

5. It was on this second prong, the prejudice that resulted from the denial of the additional funds, that the proffer was particularly weak. While the difficulty (and constitutional implications) of having to demonstrate prejudice pretrial and unassisted is frustrating, it is reality. Counsel must be able to demonstrate that trial will be fundamentally unfair, and the result likely different, unless the requested assistance is provided.

G. Essential Facets of Proffer

1. Particularized showing of need
 - a. Type of expert requested
 - b. Nature of the assistance requested
 - i. Investigate and prepare defense evidence
 - ii. Understand and confront state's evidence
 - iii. Present testimony for the defense
 - c. Particulars of what the expert would provide
2. Materiality
 - a. Significance: The subject matter (e.g., cause of death) will be a significant factor at trial or sentencing.
 - b. Relevance
3. Prejudice
 - a. How the expert will help
 - b. Particulars of what expert will do
 - i. Substance of testimony anticipated
 - ii. Description of tests to be conducted
 - iii. Testimony of state experts to be rebutted
 - c. Why trial will be fundamentally unfair w/o help (effect, weight of evidence, and results)
4. Identity of Expert
 - a. Qualifications
 - b. Availability
 - c. Cost

H. How to Proffer without Expert

1. Hire or otherwise persuade an expert to provide an affidavit explaining precisely why an expert is needed.
 - a. Generic declaration (*see, e.g.*, the second Thompson declaration included in the appended materials)
 - b. Preliminary declaration (*see, e.g.*, the first Thompson declaration included in the appended materials)
2. Where funds are not available:
 - a. Experts may feel that they are being taken advantage of
 - b. Avoid the private sector - go to academic community
 - c. Explain up front about not being able to pay
 - d. Explain that the purpose of the initial declaration is to obtain court funding
 - e. Enlist their help
3. Generic Declaration
 - a. Not case specific
 - b. Describes vastness of field
 - c. Describes complexity of field
 - d. Lists course prerequisites for graduate students
 - e. Describes importance of field - how probative science can be
4. Articles from scientific journals
5. Attach a listing of all article published in a particular field (Journal of For. Sci. - Comprehensive Index 1987- 1995)
6. Testimony in other reported cases
7. Articles from bar publications
8. Internet resources (*see, e.g.*, appended materials)

VI. Challenging the Requirements of Husske

- A. Catch 22: Counsel may need expert assistance in order to make a sufficient demonstration of need and prejudice.
- B. Requirement of Predetermination Offends Due Process and Equal Protection

1. In Husske, the Virginia Supreme Court concluded that it was impossible for Husske to prove he was prejudiced by the denial of a DNA expert because of the fact of his confession, i.e., because of the strength of the case against him
2. Husske could not show that a denial of assistance would affect the outcome
3. The Husske requirement of demonstrating prejudice means that a defendant must prove - pretrial - that denial would not be harmless
4. *Douglas v. California*, 372 U.S. 353 (1963)(the provision of counsel for purposes of appeal should not be dependent upon a court's assessment of the probable merits of the appeal): The merits of a case should not be predetermined in a proceeding where the defendant has not opportunity to meaningfully participate.

VII. IMPLICATION AND IMPORTANCE FOR ADDITIONAL DISCOVERY

- A. Demonstrate that a particular area of expertise will be a significant issue at trial. For example, introduce the Certificate of Analysis including defendant's DNA profile in DNA extracted from evidentiary item.
- B. This Certificate yields little of the information necessary to assess reliability or accuracy.
 1. Is there a protocol?
 2. Was it followed?
 3. Was the equipment maintained?
 4. Was the examiner qualified?
- C. Move for discovery/disclosure of this type of information
- D. Argue:
 1. That you cannot make the required pretrial showing unless accorded this discovery
 2. That denial of this discovery is a denial of an opportunity to make the showing required by Husske.

E. Related Decisions

1. *Ellis v. Commonwealth*, 14 Va. App. 18 (1992)(Defendant entitled to subpoena all writings used by the chemist to conclude that the substance examined and tested by him was cocaine)
2. *Hodges v. Commonwealth*, 26 Va. App. 43 (1997)
 - a. Defendant sought results of proficiency testing
 - b. State provided memo that said that examiner “passed.” (“No deficiencies were noted.”)
 - c. Denial of Mtn. To Compell affirmed by Court of Appeals
 - d. Problem: Agreed Discovery Order only obligated the state to provide a memo describing the results. The memo complied with the Order.

VIII. APPENDED MATERIALS

- A. Declaration of William C. Thompson in support of motion for DNA discovery;
- B. Declaration of William C. Thompson in support of motion for DNA expert;
- C. National Association of Criminal Defense Lawyers Forensics Website
 3. Homepage and topics
 4. Current listing of experts (each name is linked to contact information, further comments, and contact information for referring member)
 5. Sample topic page: Fingerprints and Bitemarks. Related links.
 6. Sample topic page: Crime Labs. Related links.
 7. Sample topic page: Troubling Crime Lab Stories. Related links.
 8. Sample topic page: Eyewitness Identification. Related links.
- D. Crimelynx Website: <http://www.crimelynx.com/>
- E. National Clearinghouse for Science, Technology and the Law at Stetson University College of Law (federally funded project of the National Institute of Justice) website: <http://www.ncstl.org/home>

Declaration of William C. Thompson, J.D., Ph.D.

1. I am a professor in the Department of Criminology, Law & Society at the University of California, Irvine (UCI). I am also a member of the California Bar. I have been studying and writing about forensic DNA evidence since 1988. I have published over 25 academic and professional articles on the subject. I have participated, as co-counsel for the defendant, in five cases involving forensic DNA evidence. I have also assisted several convicted individuals in obtaining post-conviction DNA testing. I am frequently invited to conduct workshops and training sessions for criminal defense lawyers on how to deal with DNA evidence. For example, I have conducted extensive workshops on DNA evidence for the offices of the public defender in Washington, D.C., Philadelphia, Chicago (Cook County, Illinois) and Los Angeles. Last May I participated as faculty member in a training conference on genetic evidence for judges in the state of Missouri. I recently served as the Reporter for an American Bar Association committee charged with recommending national standards for the use of DNA evidence in criminal trials. I also served as ABA representative on the National Forensic DNA Review Panel, which provided advice and oversight concerning a Congressionally-mandated study of the feasibility of blind proficiency testing of forensic DNA laboratories.
2. I am very familiar with STR DNA testing of the type performed at the FBI laboratory. I have studied the professional literature on STR testing. Last year, I participated in a 3-day training course on STR testing at the National Forensic Science Research and Training Center, in Tampa Florida. I participated in a day-long training session on STR testing at the International Conference on Forensic Science in 1999. I have served as a consultant to defense counsel in more than fifteen cases involving STR testing and was qualified to testify in one case as an expert witness on the calculation of statistical likelihood ratios in connection with STR DNA tests. I am currently preparing an academic article on problems that can arise in STR DNA testing. I also gave an invited presentation on problems in STR DNA testing to the California Association of Criminalists. I will discuss the same issue in a presentation next month at a national conference on Science and Law sponsored by the National Institute of Justice.
3. Mr. Steven Benjamin has asked me to express my opinion concerning the amount and type of information that a defense lawyer needs to review in order to competently represent a defendant incriminated by STR DNA testing in a case where identity (and hence the meaning and accuracy of the DNA test results) is likely to be contested. He also asked me to express my opinion on the amount of time a defense lawyer needs to prepare a competent defense in such a case. I state my views below.

4. In such a case, it is essential that the defense lawyer obtain discovery of all underlying laboratory notes, including the entire case file from the forensic laboratory that performed the DNA testing, the field notes of the police agencies that collected all relevant samples, and all documents related to chain of custody of all relevant samples. In my opinion, a defense lawyer cannot competently evaluate the DNA test results without performing a careful and intelligent review of these materials. I have personally been involved in a number of cases in which review of the underlying laboratory notes revealed significant weaknesses or problems in the DNA evidence that were not apparent from reading the laboratory report. My view on this issue is widely shared. In my experience, it is general and routine practice throughout the United States and Canada for prosecutors to provide to defense lawyers, on request, all underlying laboratory notes related to the government's DNA evidence. Indeed, during the past five years I have heard of no other cases, besides the one in which Mr. Benjamin is involved, in which a prosecutor has refused to disclose laboratory notes after receiving a properly framed request. The proposed ABA standards on DNA evidence that I drafted specify that underlying laboratory notes be disclosed to the defense on request. I recall that a prominent prosecutor and DNA expert, who served on the ABA committee with me, questioned whether such a standard was necessary because, in his view, disclosure of laboratory notes is mandatory under existing rules and is already routine practice.
5. Regarding the amount of time needed to prepare a defense, several points must be made. Obtaining the underlying laboratory notes is just the first step in evaluating a case in which the government will rely on DNA evidence. The defense lawyer will usually require expert assistance to evaluate the laboratory notes, and this is particularly true for STR DNA testing, which is highly technical and complex. Often, the initial review of the laboratory notes will disclose ambiguities or areas of concern that require further examination. In about half of the STR cases that I have examined, I recommended that the defense lawyer obtain additional discovery of the electronic data files generated in the laboratory in order to allow more detailed examination of the test results. Forensic laboratories routinely provide the electronic data files, on request, either on CD-ROMs, Jazz disks, or Zip disks. Once the data files are obtained, they must be analyzed by an expert who has access to the proprietary software. Because there are only a few experts in the United States who have access to the software and who have experience analyzing cases on behalf of defendants, and because these experts are heavily booked, there often are long delays in obtaining review of the electronic data. However, in my experience, review of the electronic data has been a very productive source of information for defense lawyers seeking to challenge DNA test results. Often this type of review reveals significant issues that were not apparent from review of the laboratory notes, such as the presence of additional genetic markers that may indicate an additional contributor, and the presence of technical problems that may cast doubt on the reliability of the genetic assays. Once the electronic data are reviewed, the lawyer still needs time to consider the meaning and implications of the findings. It is only at this stage, when the defense lawyer has a good

understanding of the government's DNA evidence, that the defense lawyer can intelligently evaluate whether to retest samples already tested by the government, whether to seek DNA testing of additional untested samples, and whether to perform other types of scientific analysis on samples that might cast light on the meaning of the government's DNA test results (such as efforts to determine the precise nature of the samples, their age, or whether they contain substances other than DNA that might help explain their source). In my experience, the process that I have just described takes a minimum of four to six months to complete beginning from the time the defense lawyer first receives the underlying laboratory notes. The process is likely to take even longer if the defense decides, upon reviewing the government's DNA evidence, to perform additional scientific testing.

6. DNA experts can provide little meaningful assistance to defense lawyers if the only documentation they have available is the final report of the laboratory that performed the tests. These reports are typically cursory summaries of the tests that were performed and the laboratory's conclusions. They do not contain the underlying data necessary to critically assess and evaluate the laboratory's conclusions. My experience, as stated earlier, is that review of the underlying laboratory notes and electronic data often reveal weaknesses and problems in STR DNA tests that are not apparent from reading the laboratory report. For example, in cases I have personally examined, review of the underlying notes and data have revealed accidental switches of critical samples (which in one case falsely incriminated the defendant), failure of critical experimental controls, presence of DNA from unreported additional contributors, and unreported discrepancies between the DNA profiles that were reported to "match." In my experience, these problems are not rare. They are sufficiently common that, in my view, a defense lawyer who fails to check for them has not competently represented his or her client.

William C. Thompson

William C. Thompson
September 4, 2001

Declaration of William C. Thompson, J.D., Ph.D.

1. I am a professor in the Department of Criminology, Law & Society at the University of California, Irvine (UCI). I have been studying and writing about forensic DNA evidence since 1988. I have published over 25 academic and professional articles on the subject. I am particularly interested in the interpretation and statistical characterization of DNA test results. I have published articles on this topic in scientific journals, such as *Genetica* and the *Journal of Forensic Sciences*. I have delivered invited addresses on interpretation of DNA evidence at professional conferences sponsored by several organizations, including the National Institute of Justice, the Association of Forensic DNA Analysts and Administrators (AFDAA), the California Association of Criminologists (CAC), and the International Association of Forensic Science. I was an appointed member of the National Forensic DNA Review Panel, which provided advice and oversight concerning a study mandated by Congress of the feasibility of blind proficiency testing of forensic DNA laboratories. I also served as an appointed member of an American Bar Association committee charged with recommending national standards for the use of DNA evidence in criminal trials. I have testified as an expert witness on forensic DNA evidence (focusing on interpretation of problematic results) in two cases. As a member of the California Bar, I have served as co-defense counsel in six criminal cases involving forensic DNA evidence. I frequently attend and participate in scientific meetings related to forensic DNA testing. I have participated in a number of workshops and training programs on forensic DNA evidence, and specifically on systems for automated analysis of STRs. I have reviewed and evaluated STR based DNA tests in more than 50 cases. My curriculum vitae is attached.
2. Mr. Elliott Bender asked me to review a laboratory report prepared by the Division of Forensic Science of the Department of Criminal Justice Services of the Commonwealth of Virginia in the case of Commonwealth v. Reginald Howard. Mr. Bender asked whether this report (dated February 6, 2003) raised any issues or indicated any potential problems that would warrant appointment of a defense expert to evaluate the underlying test results. After carefully reviewing the report, I told Mr. Bender that I strongly recommend appointment of a defense expert to examine the test results and to assist defense counsel in understanding the strengths and limitations of the DNA evidence. In fact, for reasons I will elaborate below, I believe that Mr. Bender will be unable to provide adequate assistance to his client in this matter without the advice and assistance of an independent DNA expert.
3. The most important finding in the laboratory report concerned a stain on the underwear of the alleged victim of a sexual assault. According to the laboratory report, the DNA profile obtained from this stain "is consistent with a mixture" and neither the alleged victim nor the defendant "can be eliminated as possible contributors to the genetic material detected in this mixture." The report goes on

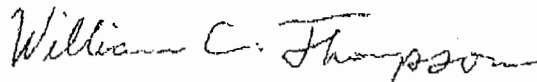
to state that the DNA profile thus obtained is "2 billion times more likely if it originated from [the victim] and [the defendant] than if it originated from [the victim] and an unknown individual in the Caucasian population." However, the genetic profiles of the samples, which are tabulated in the report, are not entirely consistent with these conclusions. In fact, a number of disturbing discrepancies are apparent:

- a. A genetic probe designed to determine gender reportedly failed to detect any male DNA in the mixed sample that is reportedly consistent with defendant, who is a male.
 - b. Approximately half of the defendant's alleles (genetic markers) are missing from profile of the mixed sample. In other words, the DNA profile of the mixed sample is "consistent" with the defendant's profile only if one assumes (without independent proof) that the DNA test detected only half of defendant's genetic markers and failed to detect the other half.
 - c. The statistical calculations presented in the report are based entirely on the portion of the genetic data that are consistent with the theory that defendant is a contributor to the mixed stain. The statistics ignore the portion of the genetic data that are inconsistent with this theory. Consequently, these statistics may greatly understate the likelihood of a coincidental match and may be severely biased against the accused.
4. Failure to detect some of defendant's alleles in the mixed sample does not necessarily eliminate him as a contributor. Forensic laboratories often call "matches" on the basis of "partial profiles" where there is good reason to suspect that technical problems or inadequate samples made it impossible to detect a complete profile. But whether good grounds exist for declaring the defendant's profile "consistent" with the underwear stain, notwithstanding the numerous discrepancies between those profiles, is an issue that warrants careful evaluation. I have frankly never encountered a case in which there are as many apparent discrepancies between allegedly "consistent" profiles as I see here. In theory, even a single discrepancy between two DNA profiles constitutes proof that they could NOT be from the same person. Here there are discrepancies between the defendant's profile and the profile of the mixed sample at eight of the sixteen genetic loci examined by the test. I believe most forensic laboratories would have declared their findings inconclusive if they found so many discrepancies.
5. In order to determine whether discrepancies of this magnitude are plausible if defendant is really a contributor to the mixed sample, a knowledgeable expert will need to look closely at the operating characteristics of the DNA test kit utilized by the laboratory and at the actual testing conditions. This will require, at a minimum, a careful review of the underlying laboratory notes in this case and, more broadly, a review of the laboratory's validation of its testing methods.

Review of validation records is particularly important in this instance because the laboratory used a relatively new test kit (PowerPlex 16) which is not widely used in forensic science and with which the forensic science community has not yet accumulated a great deal of experience.

6. There is considerable dispute in the scientific community about the proper statistical characterization of "partial" DNA profile matches, such as the one reported in this case. I believe that the method utilized by the Commonwealth's laboratory would not be generally accepted in the scientific community. And I believe that most independent experts who examined the evidence would support alternative methods that would be far more favorable to the defendant.
7. The scientific issues in this case are extremely complex. Whether the DNA profiles are indeed "consistent" as reported, and whether the statistical characterization of that finding is appropriate, are highly technical issues well beyond the scope and knowledge of most defense lawyers, even highly experienced lawyers. To expect a defense lawyer to evaluate issues of this complexity without expert assistance is to expect too much. My opinion, as both a DNA expert and a lawyer who has litigated DNA cases, is that Mr. Bender will be unable to provide adequate assistance to his client in this case without expert assistance.

Respectfully submitted,



William C. Thompson
Irvine, California
February 20, 2003

Forensics Evidence Committee

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2004-05 Appointments

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Experts Listed Alphabetically

Expert ♦

[Agnese, Mike](#)
[Amos, Gary](#)
[Arvizu, Janine](#)
[Arvizu, Jeanine](#)
[Blake, Cleland](#)
[Boyell, Roger](#)
[Brezinski, Dr. Darlene](#)
[Butler, David J.](#)
[Bux, Dr. Robert](#)
[Chamberlin, Michael](#)
[Charles, Joel](#)
[Craig, Dan](#)
[Cunningham, Ph.D., ABPP, Mark](#)
[Daniels, Charlie](#)
[Davis, Dr. Trina](#)
[DeForest, Dr. Peter](#)
[Eddings, Pat](#)
[Fairchild, Keith](#)
[First Amendment Lawyers' Associatio](#)
[Ford, Simon](#)
[Friedman, Alan](#)
[Genetic Technologies,](#)
[Genetic Technologies,](#)
[Gietzen, Gene N.](#)
[Ginsberg, Paul](#)
[Girndt, Don](#)
[Grassian, MD, Stuart](#)
[Griffin, Esq., Joan](#)
[Halleck, Seymour](#)
[Hall, Dr. Terry](#)
[Haney, Craig](#)
[Hart, Kim](#)
[Haskell, Neal H.](#)
[Hensley, Bill](#)
[Hollien, Dr. Harry](#)
[James, Stuart](#)

Expertise

Fed. Drug Investigations
 Computer
 Laboratory
 Chemistry
 Pathology
 Cellular Phones
 Paint/Plastics
 Firearms
 Child Abuse,Pathology
 Crime Scene
 Voice Analysis
 Dog Trainer/Handler
 Psychology
 Polygraph
 Sexual Abuse
 Crime Scene
 Chemistry
 Fingerprints
 Obscenity
 DNA Generally
 DNA Nuclear Testing
 DNA Generally
 DNA Nuclear Testing
 Chemistry
 Video Audio Tape
 Shoeprint
 Psychology
 Firearms
 Neuropsychologist/Psychiatrist
 Chemistry
 Psychology
 Child Abuse
 Entomology
 Crime Scene
 Voice Analysis
 Crime Scene

<u>James, Stuart H.</u>	Blood
<u>Johnson, James A.</u>	Polygraph
<u>Johnson, Libby</u>	DNA Generally
<u>Kelly, Michael</u>	Shoeprint
<u>Kish, Paul</u>	Blood
<u>Koechel, Tim</u>	Accounting
<u>Krane, Dan</u>	DNA Generally
<u>Krueger, Richard</u>	Sexual Addiction
<u>LabCorp,</u>	DNA Nuclear Testing
<u>Lawson, Marcus</u>	Child Porn
<u>Lawson, Marcus</u>	Computer
<u>Lord, Wayne</u>	Entomology
<u>Martinez, Dr. Terry</u>	Chemistry
<u>Martinez, Dr. Terry</u>	Toxicology
<u>Mazur, Eric</u>	Computer
<u>McKenna, Patrick J.</u>	Investigations
<u>McRoberts, Alan</u>	Fingerprints
<u>Miller, Dr. Marvin</u>	Child Abuse,Pathology
<u>Miller, Stevens</u>	Computer
<u>Minor, Paul</u>	Polygraph
<u>Mitotyping,</u>	DNA Mitochondrial Testing
<u>Morton, Chuck</u>	Shoeprint
<u>Morton, Chuck</u>	Shoeprint
<u>Moses, Ken</u>	Fingerprints
<u>Mutter, Charles</u>	Hypnotherapist
<u>Mutter, Commander Bobby</u>	Dog Trainer/Handler
<u>Myers, Dr. Lawrence J.</u>	Dog Trainer/Handler
<u>Nat'l Clearinghouse for the Defense</u>	Psychology
<u>Nicely, Steve</u>	Dog Trainer/Handler
<u>Nichols, Dr. David</u>	Psychopharmacology
<u>Nippes, Dan</u>	DNA Nuclear Testing
<u>OWL Investigations,</u>	Video Audio Tape
<u>Pincus, Jonathan</u>	Neurology
<u>Plunket, MD, John</u>	Child Abuse,Pathology
<u>Puryear, MD, Lucy J.</u>	Psychology
<u>Raskind, David</u>	Polygraph
<u>Rea, John</u>	Investigations
<u>Reis, George</u>	Video Audio Tape
<u>Rhodes, Nancy</u>	Linguistics
<u>Ritzline, Earl</u>	DNA Nuclear Testing

[Rosenbloom, Dr. Arlan](#)
[Ross, Wayne](#)
[Rudin, Norah](#)
[Schoenfeld, Dr. Gene](#)
[Sedgwick, Ph.D., Brian](#)
[Shields, William](#)
[Siegel, UCLA, Dr. Ronald K.](#)
[Skolar, Joseph](#)
[Smith, Paulette](#)
[Smith, Paulette](#)
[Speckin Lab,](#)
[Spitz, Dr. Daniel J.](#)
[Spitz, Dr. Weiner](#)
[Stalcup, Dr. Alex](#)
[Stambler, Errol](#)
[Steele, John A.](#)
[Suen, Dr. John](#)
[Technical Associates,](#)
[Thompson, Bill](#)
[Tobin, William \(Bill\)](#)
[Toss, Brian](#)
[Treuting, John](#)
[Tytel, Peter](#)
[Uczinski, MD, Ronald](#)
[van der Kolk, MD, Bissell](#)
[Welch, William](#)
[Woodford, Dr. James](#)
[Young, Robert](#)

Child Porn
 Child Abuse, Pathology
 DNA Nuclear Testing
 Psychiatrist
 Chemistry
 DNA Nuclear Testing
 Psychopharmacology
 Computer
 Accounting
 Accounting
 Crime Scene
 Pathology
 Pathology
 Psychopharmacology
 Chemistry
 Chemistry
 Neurology
 DNA Nuclear Testing
 DNA Generally
 Metallurgy
 Knots
 Toxicology
 Handwriting
 Child Abuse, Pathology
 Psychology
 Firearms
 Chemistry
 Computer

Fingerprints & Bitemarks

▼ Suggested Reading

Cole, Simon A.	<i>Suspect Identities : A History of Fingerprinting and Criminal Identification</i> (2002) (Abstract: The book that launched the Plaza case and lots of other challenges to fingerprint matching.) Order from Amazon.com
Ashbaugh, David R.	<i>Quantitative-Qualitative Friction Ridge Analysis: An Introduction to Basic and Advanced Ridgeology</i> (1999) (Abstract: One of the foundation books of modern fingerprint matching methods by the creator of the Ridgeology system.) Order from Amazon.com

▼ Web Links

U.S. v. Mitchell (3rd Cir. 2004)	Decision upholding admissibility of latent print testimony. More info available at http://www.clpex.com/Mitchell.htm .
The Weekly Detail	A weekly newsletter by and for latent fingerprint examiners. Often useful to research current issues in fingerprint identification and examiners' views of legal challenges.
Onin's Fingerprinting Forum	A fingerprint examiner's site collecting information about, among other things, Daubert challenges. A good place to start research into legal challenges of fingerprints.
SWGFAST	Standards for fingerprint examinations recommended by a scientific working group on the topic.
Am. Academy of Forensic Sciences	One of several professional organizations which certify document examiners and other experts Publisher of the Journal of Forensic Sciences << Searchable Index >>
Bowers on Bitemark Evidence	Paper presented reviewing literature on bitemarks in 2000, http://www.forensic.to/webhome/bitemarks/

▼ Champion Articles

Steele	Trying Identification Cases
Imwinkelried & Cherry	The Myth Of Fingerprints
Sands	A Graphic Crime Scene
Hrones	The Phoney Fingerprint
Cherry, Imwinkelried, & Meyer	Does The Use Of Digital Techniques By Law Enforcement Authorities Create A Risk Of Miscarriages

	Of Justice? Digital Evidence Problem.
Thompson & Cole	Lessons From The Brandon Mayfield Case

▼ **Briefs & Motions**

Commonwealth v. Stephen Cowans	Commonwealth v. Stephen Cowans, Motion for New Trial, Memorandum , and excerpts of transcripts of the fingerprint experts (McLaughlin and LeBlanc) who ID'd Cowans as the culprit.
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Crime Labs

[> Troubling Crime Lab Stories](#)

▼ Suggested Reading

	National Academy of Sciences, Forensic Analysis: Weighing Bullet Lead Evidence (2004). Available from: www.nap.edu . Discussion and criticism of the FBI's Compositional Analysis of Bullet Lead
Kelly & Wearne	Tainting Evidence: Inside The Scandals At The FBI Crime Lab (1998) . An overview of the Inspector General's investigation into the FBI lab
Dept. of Justice	Office of the Inspector General, The FBI Laboratory One Year Later: A Follow-Up to the Inspector General's April 1997 Report on FBI Laboratory Practices and Alleged Misconduct in Explosives-Related and Other Cases (June 1998) . Discussion of the results of the OIG recommendations
Dept. of Justice	Office of the Inspector General, The FBI Laboratory: An Investigation into Laboratory Practices and Alleged Misconduct in Explosives-Related and Other Cases (April 1997) . The report on problems at the FBI Lab
Jonakait	Real Science and Forensic Science. 1 Shepard's Expert & Scientific Evidence Quarterly 435-455 (1993). Criticism of how forensic science is performed
Jonakait	Forensic Science: The Need for Regulation, 4 Havard J. of Law and Tech. 109 (Sp. 1991). Criticism of how forensic science is performed

▼ Web Links

Forensic Fraud Database	Collection of links and reprinted stories
Law-Forensic.com	Collection of links to articles on crime lab stories
Daubert & Criminology/Forensics	Compilation of Daubert decisions on various topics.
Am. Society of Crime Lab Dirs	
Am. Academy of Forensic	One of several professional organizations which certify

Sciences	document examiners and other experts Publisher of the Journal of Forensic Sciences << Searchable Index >>
National Legal Aid & Defender Association Forensic Library	Useful collection of materials, articles, links, etc. Free with registration.

▼ Champion Articles

Whitehurst, Fred	Forensic Crime Labs...(Part 1) , An overview of problems with crime labs and 10 things to look for in discovery of crime lab testing/results
Whitehurst, Fred	Forensic Crime Labs...(Part 2) , An overview of problems with crime labs and 10 things to look for in discovery of crime lab testing/results
Wolf, William P.	Practice Points- Preparing to Cross-Examine an Expert Witness-- Part 1 , Good advice on reviewing and challenging scientific experts
Wolf, William P.	Practice Points- Preparing to Cross-Examine an Expert Witness-- Part 2 , Good advice on reviewing and challenging scientific experts
Cherry, Imwinkelried, Meyer	Does the Use of Digital Techniques by Law Enforcement Authorities Create a Risk of Miscarriage of Justice? Generic Evidence Problem

Troubling Crime Lab Stories (Sorted by Crime Lab)

▼ Austin Police Department

[Blood](#)

▼ Baltimore County Police Department

[Blood](#)

▼ Bexar County Medical Examiner

[Blood](#)

▼ Boston Police Department

[Fingerprints](#)

[Fingerprints](#)

▼ Broward County (FL) Sheriff's Crime

[DNA Generally](#)

▼ Cape May County Medical Examiner's

[Autopsies](#)

▼ Chicago Police Laboratory

[Blood](#)

▼ Cleveland Police Department

[Trace -- Hair & Fiber](#)

▼ Connecticut DCF

[Child Abuse](#)

▼ Connecticut State Police

[Polygraph](#)

▼ Connecticut State Toxicological Lab

[Trace -- Hair & Fiber](#)

▼ **Delaware County CID**

[Fingerprints](#)

▼ **Emmanuel Children's Hospital**

[Child Sex Abuse](#)

▼ **FBI**

[DNA Generally](#)

[Fingerprints](#)

[Ballistics](#)

[Fingerprints](#)

[Fingerprints](#)

[Crime Scene](#)

[Ballistics](#)

[Firearms](#)

[Trace -- Hair & Fiber](#)

[Trace -- Other](#)

▼ **Florida Department of Law Enforcement**

[DNA Generally](#)

[Trace -- Hair & Fiber](#)

▼ **Forensic Identification Services**

[Fingerprints](#)

▼ **Forensic Pathology Associates, P.C.**

[Autopsies](#)

▼ **Fort Worth Police Crime Lab**

[DNA Generally](#)

▼ **Garden City Police Dept.**

[Fingerprints](#)

▼ **Great Lakes Search & Rescue**

[Dog Trainer/Handler](#)

▼ **Houston Police Department Crime Lab**

[Crime Lab Administration](#)

[Crime Lab Administration](#)

[Crime Lab Administration](#)

[Chemistry](#)

[DNA Generally](#)

[Ballistics](#)

[DNA Generally](#)

[DNA Generally](#)

[DNA Generally](#)

[Crime Lab Administration](#)

▼ **Illinois State Police**

[Blood](#)

▼ **Illinois State Police Forensic Scie**

[DNA Generally](#)

▼ **JTC Consulting**

[Questioned Documents](#)

▼ **Kansas Bureau of Investigation**

[DNA Generally](#)

▼ **Las Vegas Police**

[Fingerprints](#)

▼ **Las Vegas Police Crime Lab**

[DNA Generally](#)

▼ **Los Angeles Police Crime Lab**

[Chemistry -- Narcotics Testing](#)

▼ **Marion County Forensic Services Age**

[DNA Generally](#)

▼ **Marion Co. Forensic Services Agency**

[Crime Lab Administrator](#)

▼ **Massachusetts Medical Examiner**

[Autopsies](#)

[Autopsies](#)

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[Autopsies](#)

▼ **Memphis Regional Forensic Center**

[Autopsies](#)

▼ **Michigan Department of Corrections**

[Psychology](#)

▼ **Michigan State Police Crime Lab**

[DNA Generally](#)

▼ **Missouri State Highway Patrol**

[Chemistry](#)

[Chemistry](#)

▼ **Montana State Police**

[Trace](#)

▼ **National Burn Victims Foundation**

[Pathology](#)

▼ **New Hampshire Medical Examiner Offi**

[Crime Scene](#)

▼ **New Mexico Office of the Medical In**

[Dentist/Bitemarks](#)

▼ **New York State Police**

[Fingerprints](#)

▼ **New York State Police Crime Lab**

[Blood](#)

▼ **New York State Police Southern Tier**

[Chemistry](#)

▼ **none**

[Psychology](#)

▼ **Oklahoma City Police**

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▼ **Orchid Cellmark**

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▼ **Pennsylvania State Police Crime Lab**

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▼ **Phoenix Crime Lab**

[DNA Generally](#)

▼ **Pinellas-Pasco Medical Examiner's O**

[Autopsies](#)

[Autopsies](#)

- ▼ **San Francisco Police**
[Chemistry](#)
- ▼ **Texas Department of Public Safety**
[Fingerprints](#)
- ▼ **Texas Fire Marshals Office**
[Crime Scene](#)
- ▼ **Texas Medical Examiner**
[Autopsies](#)
- ▼ **Texas State Crime Lab**
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- ▼ **Travis County Medical Examiner's Of**
[Autopsies](#)
- ▼ **United States Secret Service**
[Questioned Documents](#)
- ▼ **University of North Carolina**
[Shoeprint](#)
- ▼ **Unknown Department in Vermont**
[Fingerprints](#)
- ▼ **Upper Darby (PA) Police**
[Fingerprints](#)
- ▼ **Vermont State Police Crime Lab**
[Fingerprints](#)
- ▼ **Virginia Division of Forensic Scien**
[Trace -- Hair & Fiber](#)
- ▼ **Washington State Patrol**

[Trace](#)

[Chemistry](#)

[DNA Generally](#)

[DNA Generally](#)

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[DNA Generally](#)

[Fingerprints](#)

▼ **Wenatchee Police Department**

[Child Sex Abuse](#)

▼ **West Texas area medical examiner**

[Autopsies](#)

▼ **West Valley City Police Department**

[Fingerprints](#)

▼ **West Virginia State Police**

[Blood](#)

[Chemistry](#)

[Chemistry](#)

▼ **Westchester Medical Center Psych. U**

[Psychiatrist](#)

▼ **Winnebago County Coroner's Office**

[Autopsies](#)

▼ **Wisconsin State Crime Laboratory**

[Fingerprints](#)

▼ (Not Categorized)

[Dog Trainer/Handler](#)

[Psychopharmacology](#)

[Fed. Drug Investigations](#)

[Psychiatrist](#)

[Trace -- Other](#)

[Psychiatrist](#)

Eyewitness Identification

▼ Pending Legislation

Connecticut	H.B. 6612 (see pp. 9-12)
Connecticut	H.B. 5678
Connecticut, 2002	Bill No. 5678 , Committee to set Guidelines
Massachusetts	S. 173
Oregon	H.B. 2067
Rhode Island, 2004	Senate Bill 2229 . Lineup/Array Cautionary Instructions, Composition, Double-Blind. Contact Person: Michael DiLauro <madpd2001@yahoo.com>
Rhode Island, 2004	Senate Bill 2229A . Lineup/Array Cautionary Instructions, Composition, Double-Blind. Contact Person: Michael DiLauro <madpd2001@yahoo.com>
Rhode Island, 2004	House Bill 7575 . Lineup/Array Cautionary Instructions, Composition, Double-Blind. Contact Person: Michael DiLauro <madpd2001@yahoo.com>
Rhode Island, 2004	House Bill 6102/S. 351 & Explanation of need for this legislation.

▼ Suggested Reading

Heaton-Armstrong, Shepherd, and Wolchover	Analysing Witness Testimony (1999). UK-oriented text on witness memory and perception, including child memory, effects of drugs, sleep and dream-related memories, hypnosis, and more. Includes a discussion of recording witness interviews (recording has been mandatory for custodial interrogations in UK since 1984). Overall, a fine text for practitioners interested in the topic. Order from Amazon
Doyle	True Witnesses: Cops, Courts, Science and the Battle Against Misidentification (2005). A history of psychologists and the justice system's struggles over eyewitness ID issues. Useful as an overview of the major personalities, cases, and how the current situation came to be. Contains 10 pages of endnotes listing useful books and articles. Order from Amazon

▼ CLE Materials

Trying the Eyewitness Case: Applying the Science Presented October 16th, 2004 at NACDL's Fall Meeting in Atlanta, Georgia	Password Accessible Website. If you are having trouble accessing this website, please contact Caller Schiller at (202) 872-8600 ext. 255 or email her at schiller@nacdl.org .
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▼ Web Links

ABA Innocence Committee	Report and Proposed Resolution regarding Eyewitness Identification Best Practices: A. Report ; B. Resolution ; C. Statement of Best Practices
Innocence Project	Mistaken I.D.s
New York State Defenders Association	Eyewitness evidence
PBS Frontline	Examining eyewitness errors in crimes
David Feige, Bronx Defenders	Eyewitness ID Issues
Inquiry Regarding Thomas Sophonow	Canadian report by DOJ on wrongful convictions with recommendations for reform, appendix A at 137 (2001)
Professor Gary Wells' homepage	Articles and useful materials from one of the foremost experts on eyewitness identification.
Department of Justice Eyewitness Guide	Recommendations by DoJ about how to handle line-ups and photo arrays. Useful for motions, cross-exam, and closing argument, but not mandatory.
Professor Saul Kassin's Eyewitness Articles	Another good guide to psychological articles by one of the noted researchers in the field.
Report on the Task Force on Eyewitness Evidence (Suffolk County, Mass)	Report discussing eyewitness ID reforms to police procedure and prosecutor protocols.
DoJ Training Manual on Eyewitness Evidence	More fodder for cross-exam and motions on suggestive show-ups, lineups, photo arrays, and other ID procedures.
Report of the Illinois Commission on Capital Punishment (April, 2002)	See Chapter 2.
Eyewitness Identification Research Laboratory At the University of Texas at El Paso	Helpful index to articles on eyewitness ID
UK Crown Prosecution Service Materials on Identification	Considers the different types of evidence that should be considered by prosecutors and what sort of quality is required to secure a conviction. It also considers whether or not the issue of identification is relevant or not.
American Psychology-Law Society Eyewitness Publication List	Exhaustive list of publications on eyewitness issues.

▼ Briefs / Motions

State v. LaQuan Ledbetter (CT 2004)	Challenge to U.S. Supreme Court standards in Niel/Manson based on scientific research into link between confidence and accuracy since 1970s. State v. LaQuan Ledbetter (CT 2004), State v. LaQuan Ledbetter, reply brief , State Brief , Innocence Project's Motion to File Amicus Brief and Application as Amicus (discussing State v. Reid, a CT case holding cautionary instruction that suspect may not be in an array or at a show-up unnecessary). Amicus of The Innocence Project et als. regarding eyewitness ID issues.
State v. Maestas (UT 1997)	
State v. Coley (32 S.W.3d 31 (2000))	Arguing for admissibility of expert testimony on ID under Frye test. Affirmed, 3-2 decision.
People v. Samuel (NY 03/06/2003)	People v. Samuel :Users should be sure to read the revised Steblay article, because since these motions were drafted, one of the supporting articles was amended, which affects some of the conclusions. Multiple files include: (1) Motion and Memorandum regarding double-blind lineup; (2) Affidavit of Steven Penrod in support of motion; and (3) Reply to State's Opposition to motion.
State v. Grier (NC Appellate Court 8/02)	Sufficiency claim and state/federal constitutional challenge to eyewitness ID that makes good use of the research.
People v. Thompson (NY 10/14/2001)	People v. Thompson : Motions regarding request for sequential lineup. Note that the research (circa 2001) has been superceded. Counsel using this motion as a guide should check latest material on the effects of sequential procedures on false positives and false negatives. Files include: (1) File-1 ; (2) File-2 ; (3) File-3 .
People v. Franco (NY 2001)	Motion and supporting memoranda for double-blind sequential lineup
State v. Nogueira (CT 2004)	State v. Nogueira , Appellant's brief and index to appendix challenging Manson v. Braithwaite. Intermediate appellate court bound by State Supreme Court and SCOTUS rulings and could not address the issue.
U.S. v. Johnson (DC 2004)	Motion to Suppress Eyewitness ID
Fulero's Sample Affidavit	
Motion to Obtain Expert Witness	
In Limine Motion and Supporting Memo	

▼ Champion Articles

Feige	I'll Never Forget that Face
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Scheck	Freeing the Innocent
Nettles	I noticed you paused
Doyle	No Confidence
Doyle	Two Stories
Sands	A graphic crime scene
Tarlow	Too Clever by Half
Steele	Trying Identification Cases
Wells	Eyewitness Identification Evidence: Science And Reform
Steele	Reforming Identification Law Strategies And Goals
O'Toole	District Of Columbia Public Defender Eyewitness Reliability Survey
Ehlers	Eyewitness Identification State Law Reform

▼ Treatises

Loftus & Doyle, Eyewitness Testimony: Civil & Criminal (3rd Ed. 1998)	A lawyer's guide to this field, includes sample motion language, cross-exams, and opening/closing arguments.
Cutler & Penrod, Mistaken Identification: The Eyewitness, Psychology, and the Law (1995)	A good collection of studies and policy advice, should be supplemented with studies since 1995.
Loftus, Eyewitness Testimony (1996)	A good discussion of the field by one of the best known writers.
Loftus, Eyewitness Testimony (1979)	The fountainhead of many eyewitness ID cases and challenges, largely superceded by the 1996 edition.

CHAPTER II:

**UNDERSTANDING DNA EVIDENCE:
WHAT DEFENSE LAWYERS
NEED TO KNOW**

By

Professor William C. Thompson

Houston Has A Problem: Bad DNA Evidence Sent the Wrong Man to Prison at Least Once. How Many More are There and What Can be Done About it?

by William C. Thompson



Josiah Sutton's nightmare began on October 30, 1998 when a woman mistakenly identified him as one of two men who had raped her. The 16-year-old Houston resident demanded to have a DNA test — confident that it would prove his innocence — but the Houston Police Department Crime Laboratory reported finding his DNA profile in semen samples from the crime. After a short trial, Sutton was convicted and sentenced to 25 years in prison for a crime he did not commit. He was

[T]he work of the HPD lab was some of the worst I had ever seen. The laboratory routinely failed to follow proper scientific procedures. It interpreted DNA test results and computed statistical estimates in a manner biased against the accused. Most importantly, I found several instances in which there was outright misrepresentation of scientific findings — where the lab analysts would say that two samples had the same DNA profile when the actual test results showed they did not.

released last month after a new DNA test proved conclusively that he was not one of the rapists.

The Sutton case has added fuel to a growing controversy about the criminal justice system in Harris County, Texas — which has sent more people to death row than any other county in the nation. The problems in the Harris County Police Department (HPD) Crime Laboratory were first brought to light last fall in a series of investigative reports by television station KHOU. I was one of several experts asked by KHOU to review laboratory records and transcripts from cases processed by the DNA/Serology unit of the HPD laboratory. I was shocked by what I saw.

In televised interviews I said the work

of the HPD lab was some of the worst I had ever seen. The laboratory routinely failed to follow proper scientific procedures. It interpreted DNA test results and computed statistical estimates in a manner biased against the accused. Most importantly, I found several instances in which there was outright misrepresentation of scientific findings — where the lab analysts would say that two samples had the same DNA profile when the actual test results showed they did not.

After the television exposé, the Harris County district attorney asked a state agency, the Texas Department of Public Safety, to conduct an audit of the Harris County Police Department's DNA/Serology Laboratory. The audit report, released in January, confirmed many of the problems identified in the KHOU reports, along with some others, such as a roof in the evidence room that leaked so badly that 34 DNA evidence samples were destroyed in a single stormy night, and poorly trained DNA analysts who could not verify their academic credentials.

The scathing audit report led the district attorney to shut down the DNA/Serology laboratory pending review by an outside agency. The district attorney also agreed to allow retesting of evidence in some of the cases I had identified as problematic in the television news reports.

One of these cases was Josiah Sutton's. During Sutton's trial, a DNA analyst from the HPD lab testified that Sutton's unique DNA profile was found mixed with DNA of the victim and another man in vaginal samples from the rape victim and in a semen stain collected from the back seat of the victim's automobile, where two men had raped her. According to the lab report, the probability Sutton would match by chance was 1 in 694,000.

This statistic grossly overstated the power of the DNA evidence. Although Sutton's profile was consistent with the mixture of DNA characteristics found in the vaginal samples, these samples contained so many characteristics that thou-

sands of people would also be "consistent." By my calculations, the probability of a coincidental match in the case was actually greater than 1 in 8. But that was not the worst of it.

Examination of the DNA test results showed that the semen stain from the back seat of the car did not match Sutton, as the laboratory report had stated — it appeared to be from an unknown man. Based on his DNA profile, this unknown man could have been one of the two rapists whose semen was found in the vaginal samples. But if he was one of the two rapists, Josiah Sutton could not have been the other. Sutton's DNA, when combined with that of the back seat semen donor, could not account for the mixture of genetic characteristics found in the vaginal samples. So if one makes the reasonable assumption that the semen donor was one rapist, Sutton was ruled out as the other.

The jury that convicted Sutton never heard about this problem. It was led to believe that the DNA evidence uniquely identified Sutton as one of the rapists, when it actually provided strong evidence of his innocence. The case is a striking example of what can happen when defense lawyers accept laboratory reports and expert testimony at face value without examining the underlying scientific data.

In early March, a new test of semen from the vaginal swab, in a private laboratory, revealed the DNA profiles of two men — and conclusively ruled out Sutton as a possible contributor. Because the victim had made it clear that the two rapists were the only possible sources of the semen, the new test firmly establishes his innocence. He was released on bail March 12, 2003 pending a petition to the state governor for a full pardon.

In light of Sutton's exoneration, the question is no longer whether innocent people have been sent to prison by bad lab work in Houston, but how many, whether any have been executed, and what it will take to find them. The district

continued on page 17

attorney is currently reviewing his files to identify cases as far back as 1992 in which DNA evidence produced the HPD laboratory figured in a conviction. So far prosecutors have ordered retesting in the cases of 68 prisoners, 17 of whom are on death row.

Many more retests may be needed. In some of the most problematic cases retesting may be impossible, however, because the HPD inappropriately consumed all of the evidence in the first round of DNA testing.

The Texas state legislature has held a series of hearings to find out what went wrong with the Houston lab, and what might be done about it. One obvious factor is the dysfunctional nature of the criminal justice system in Houston, where court appointed defense attorneys have found it difficult even to obtain copies of laboratory reports before trial, and rarely are able to have independent experts review the underlying laboratory work.

According to a recent New York Times story, Timothy Fallon, director of the Bexar County crime laboratory in San Antonio, told a committee of the Texas Legislature this month that there was only one way to assure the integrity of DNA testing by laboratories. "Resources must be made available to criminal defense attorneys," he said. "If you want the best crime lab, you need to have the best criminal defense attorneys to challenge us."

It remains to be seen whether the Texas legislators will take this advice to heart.

For more information on the Houston laboratory problems, see the NLADA Forensics Library at www.nlada.org/Defender. ♦

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with community people and groups. Many of those resources are referenced, in this article.

The Community Justice Resource Center at the Advancement Project provides information on funding sources, civil rights data, reference publications and much more. For more information, contact cjrc@advancementproject.org or go to their Web site at www.advancementproject.org.

The New England Training Consortium is developing training materials that break down the elements of the community lawyering to teachable segments emphasizing specific community lawyering skills. For more information, contact Ellen Hemley at ehemley@mlri.org.

The OSI Community Oriented Problem Solving Working Group spans all segments of the justice system including courts, prosecutors, defenders, legal aid advocates, law schools and others. This group, including some of the session organizers and participants, is working to build an

Community lawyers flexibly employ a wide variety of strategies – media, policy, outreach, transactional approaches and litigation – to advance community goals and build the capacity of communities to negotiate on their own terms with the powers that be.

infrastructure that can support and advance a community oriented problem solving approach to working on social justice issues. For more information, contact Tanya Neiman through her assistant Cari Napoles at cnapoles@sfbar.org.

The Project for the Future of Equal Justice is working closely with all of these entities to coordinate and promote the development of infrastructure that will advance lawyering for social justice. For more information, contact Camille Holmes at cholmes@clasp.org. ♦

U.S. Supreme Court Rules In Favor of IOLTA

"More than \$160 Million Protected"

In a major victory for Interest on Lawyers' Trust Account (IOLTA) programs across the country, the U.S. Supreme Court ruled on March 25, that the Washington State IOLTA program does not violate the Fifth Amendment, upholding the 9th Circuit's 2001 en banc ruling. This ruling in *Brown v. Legal Foundation of Washington* (originally *Washington Legal Foundation v. Legal Foundation of Washington*) protects approximately \$160 million currently held in IOLTA accounts nationally. Within the legal aid community, every state uses IOLTA accounts to fund legal assistance for low-income people. An amicus brief in support of the Legal Foundation of Washington was filed jointly by the NLADA, AARP, Legal Counsel for the Elderly, Inc., and The Brennan Center For Justice.

IOLTA accounts are comprised of short-term interest earned on escrow accounts established by lawyers to hold their clients' real estate transactions and other matters. Client funds that are too small in amount or held for too short of a time to earn interest for the client, net of bank charges or administrative fees, are placed in a pooled, interest-bearing trust account. In so doing, the interest earned is used to provide legal aid for low-income people.

For more information on the IOLTA ruling, visit the NLADA Web site, www.nlada.org/Civil. ♦



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Evaluating forensic DNA evidence: Essential elements of a competent defense review

By William C. Thompson; Simon Ford; Travis Doom; Michael Raymer; Dan E. Krane

"I get a sinking feeling when I hear a client has been fingered by a DNA test," a defense lawyer recently told us. "Seems there's not much I can do but negotiate a guilty plea."



Promoters of forensic DNA testing have done a good job selling the public, and even many criminal defense lawyers, on the idea that DNA tests provide a unique and infallible identification. DNA evidence has sent thousands of people to prison and, in recent years, has played a vital role in exonerating men who were falsely convicted. Even former critics of DNA testing, like Barry Scheck, are widely quoted attesting to the reliability of the DNA evidence in their cases. It is easy to assume that any past problems with DNA evidence have been worked out and that the tests are now unassailable.

The problem with this assumption is that it ignores case-to-case variations in the nature and quality of DNA evidence. Although DNA technology has indeed improved since it was first used just 15 years ago, and the tests have the potential to produce powerful and convincing results, that potential is not realized in every case. Even when the reliability and admissibility of the underlying test is well established, there is no guarantee that a test will produce reliable results every time it is used. In our experience there often are case-specific issues and problems that greatly affect the quality and relevance of DNA test results. In those situations, DNA evidence is far less probative than it might initially appear.

The criminal justice system presently does a poor job of distinguishing unassailably powerful DNA evidence from weak, misleading DNA evidence. The fault for that serious lapse lies partly with those defense lawyers who fail to evaluate the DNA evidence adequately in their cases. This article describes the steps that a defense lawyer should take in cases that turn on DNA evidence in order to ascertain whether and how this evidence should be challenged.

Our focus here is on the most widely used form of DNA testing, which examines genetic variants called short tandem repeats, or STR's. Our goal is to explain what you need to know, why you need to know it, and how you get the materials and help you need. We leave for a future article discussion of another less common and even more problematic form of DNA testing, which examines mitochondrial DNA (mtDNA).


Understanding the lab report The first item you need in a DNA

case is the lab report. The report should state what samples were tested, what type of DNA test was performed, and which samples could (and could not) have a common source. Reports generally also provide a "table of alleles" showing the DNA profile of each sample. The DNA

profile is a list of the alleles (genetic markers) found at a number of loci (plural for "locus," a position) within the human genome. To understand DNA evidence, you must first understand the table of alleles.

FIGURE 1: TABLE OF ALLELES

Which suspect is a possible source of the blood? Only one of the four suspects has a DNA profile that matches the DNA profile observed in the blood sample



	D3S1358	VWA	FGA	Amel	D8S1179	D21S11	D18S51	D5S818	D13S317	D7S820
Blood Stain	15, 16	15, 15	25, 26	XY	12,13	27,30	13,14	10,11	9,12	10,12
Suspect 1	16, 18	15, 16	21, 24	XY	12,14	27,28	13,17	11,12	8,11	8,12
Suspect 2	15, 15	18, 18	19, 23.2	XY	13,15	29,30	17,17	11,11	8,9	9,10
Suspect 3	15, 16	15, 15	25, 26	XY	12,13	27,30	13,14	10,11	9,12	10,12
Suspect 4	16, 16	16, 17	19, 24	XY	14,14	30,30	13,16	9,11	10,11	9,10

Figure 1 shows a table of alleles, as represented in a typical lab report. This table shows the DNA profiles of five samples — blood from a crime scene and reference samples from four suspects. These samples were tested with an automated instrument called the ABI Prism 310 Genetic Analyzer™ using a set of genetic probes called ProfilerPlus™. A company called Applied Biosystems, Inc. (ABI) developed this system for typing DNA. It is currently the most widely used method for forensic DNA typing in the United States, used by about 85 percent of laboratories that do forensic DNA testing.¹

Across the top of the table are the names of the various loci examined by the test. The ProfilerPlus™ system examines ten loci. (Labs sometimes also run another set of genetic probes, called Cofiler™, which includes four additional loci). The alleles that the test detected at each locus are identified by numbers. Thus, at locus D3S1358, the test detected alleles 15 and 16 on the bloodstain. At each locus, a person has two alleles, one inherited from each parent. In some cases, only one allele is detected, which is interpreted as meaning that by chance the person inherited the same allele from each parent. (See in Figure 1, e.g., Suspect 2's profile at locus D3S1358 and Suspect 4's profile at locus D8S1179). However, most samples will have two different alleles at each locus, as seen in Figure 1.

Each allele is a short fragment of DNA from a specific location on the human genome known as an STR (short tandem repeat). STRs are places in human DNA where a short section of the genetic code repeats itself. Everyone has these repeating segments, but the number of repetitions (and hence the length of these segments) varies among individuals. The numbers assigned to the alleles indicate the number of repetitions of the core sequence of genetic code. ProfilerPlus™ identifies and labels fragments of DNA that contain STRs. The Genetic Analyzer then measures their length and thereby determines which alleles are present.

By examining the DNA profiles, one can tell whether each suspect could or could not have been the source of the blood. Suspects 1, 2 and 4 are ruled out as possible sources because they have different alleles than the blood at one or more loci. However, Suspect 3 has exactly the same alleles at every locus, which indicates he could have been the source of the blood. In a case like this, the lab report will typically say that Suspects 1, 2 and 4 are "excluded" as possible sources of the blood, and that Suspect 3 "matches" or is "included" as a possible donor. One of the loci analyzed is called amelogenin (Amel) and is used for typing the sex of a contributor to a sample. Males have X and Y versions of the alleles at that locus; females have only the X because they inherit two copies of the X chromosome. All of the profiles shown in Figure 1 appear to be of males.

Lab reports generally also contain estimates of the statistical frequency of the matching profiles in various reference populations (which are intended to represent major racial and ethnic groups). Crime labs compute these estimates by determining the frequency of each allele in a sample population, and then compounding the individual frequencies by multiplying them

together. If 10% (1 in 10) of Caucasian Americans are known to exhibit the 14 allele at the first locus (D3S1358) and 20% (1 in 5) are known to have the 15 allele, then the frequency of the pair of alleles would be estimated as $2 \times 0.10 \times 0.20 = 0.04$, or 4% among Caucasian Americans. The frequencies at each locus are simply multiplied together (sometimes with a minor modification meant to take into account the possibility of under-represented ethnic groups), producing frequency estimates for the overall profile that can be staggeringly small: often on the order of 1 in a billion to 1 in a quintillion, or even less. Needless to say, such evidence can be very impressive.

When the estimated frequency of the shared profile is very low, some labs will simply state "to a scientific certainty" that the samples sharing that profile are from the same person. For example, the FBI laboratory will claim two samples are from the same person if the estimated frequency of the shared profile among unrelated individuals is below one in 260 billion. Other labs use different cut off values for making identity claims. All of the cut-off values are arbitrary: there is no scientific reason for setting the cut off at any particular level just as there is no formally recognized way of being "scientifically certain" about anything. Moreover, these identity claims can be misleading because they imply that there could be no alternative explanation for the "match," such as laboratory error, and they ignore the fact that close relatives are far more likely to have matching profiles than unrelated individuals. They can also be misleading in that the DNA tests themselves are powerless to provide any insight into the circumstances under which the sample was deposited and are generally unable to determine the type of tissue that was involved.

Looking behind the lab report: Are the laboratory's conclusions fully supported by the test results?

Many defense lawyers simply accept lab reports at face value without looking behind them to see whether the actual test results fully support the laboratory's conclusions. This can be a serious mistake.

In our experience, examination of the underlying laboratory data frequently reveals limitations or problems that would not be apparent from the laboratory report, such as inconsistencies between purportedly "matching" profiles, evidence of additional unreported contributors to evidentiary samples, errors in statistical computations and unreported problems with experimental controls that raise doubts about the validity of the results. Yet forensic DNA analysts tell us that they receive discovery requests from defense lawyers in only 10-15% of cases in which their tests incriminate a suspect.

Although current DNA tests rely heavily on computer-automated equipment, the interpretation of the results often requires subjective judgment. When faced with an ambiguous situation, where the call could go either way, crime lab analysts frequently slant their interpretations in ways that support prosecution theories.²

Part of the problem is that forensic scientists refuse to take appropriate steps to "blind" themselves to the government's expected (or desired) outcome when interpreting test results. We often see indications, in the laboratory notes themselves, that the analysts are familiar with facts of their cases, including information that has nothing to do with genetic testing, and that they are acutely aware of which results will help or hurt the prosecution team. A DNA analyst in one case wrote:

"Suspect-known crip gang member — keeps 'skating' on charges-never serves time. This robbery he gets hit in head with bar stool — left blood trail. [Detective] Miller wants to connect this guy to scene w/DNA ..."

In another case, where the defense lawyer had suggested that another individual besides the defendant had been involved in the crime, and might have left DNA, the DNA laboratory notes include the notation: "Death penalty case. Need to eliminate [other individual] as a possible suspect."

It is well known that people tend to see what they expect (and desire) to see when they evaluate ambiguous data.³ This tendency can cause analysts to unintentionally slant their interpretations in a manner consistent with prosecution theories of the case. Furthermore, some analysts appear to rely on non-genetic evidence to help them interpret DNA test results. When one of us questioned an analyst's interpretation of a problematic case, the analyst defended her position by saying: "I know I am right — they found the victim's purse in [the defendant's] apartment." Backwards reasoning of this type (i.e., "we know the defendant is guilty, so the DNA evidence must be incriminating") is another factor that can cause analysts to slant their reports in a manner that supports police theories of the case. Hence, it is vital that defense counsel look behind the laboratory report to determine whether the lab's conclusions are well supported, and whether there is more to the story than the report tells.

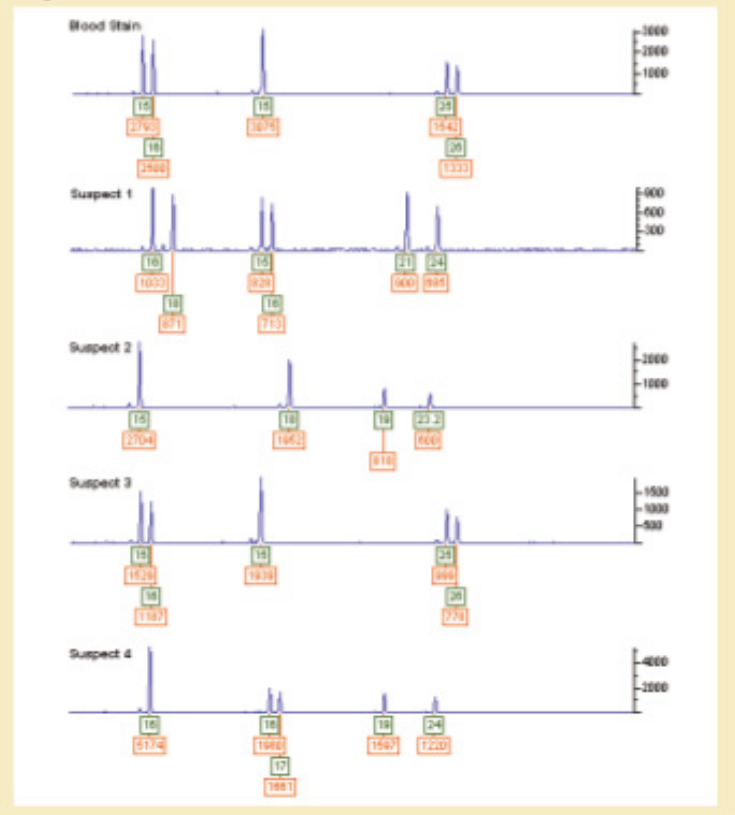
Behind the Table of Alleles Detected (Figure 1) is a set of computer-generated graphs called electropherograms that display the test results. When evaluating STR evidence, a defense lawyer should always examine the electropherograms because they sometimes reveal unreported ambiguities and, fairly frequently, evidence of additional, unknown contributors. The electropherograms shown in Figure 2 display the results for the crime scene blood and four suspects discussed above at three of the ten loci summarized in Figure 1.

The "peaks" in the electropherograms indicate the presence of human DNA. The peaks on the left side of the graphs represent alleles at locus D3S1358; those in the center represent alleles at locus vWA; and those on the right represent alleles at locus FGA. The numbers under each peak are computer-generated labels that indicate which allele each peak represents and how high the peak is relative to the baseline.

By examining the electropherograms in Figure 2, one can readily see that the computerized system detected two alleles in the blood from the crime scene at locus D3S1358. These are alleles 15 and 16, which are reported in the Table of Alleles (Figure 1). The other alleles reported in the allele chart (Figure 1) can also be seen. Our initial examination of these electropherograms reveals no obvious problems of interpretation in this case.

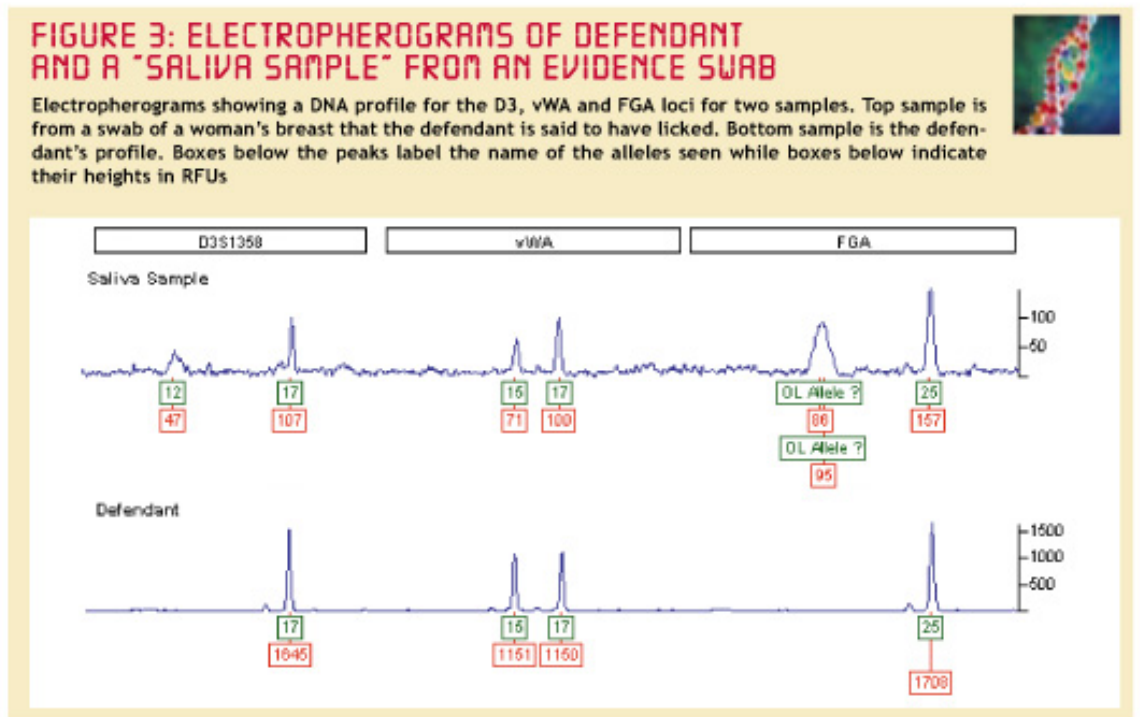
FIGURE 2: ELECTROPHEROGRAMS

Showing the Results of ProfilerPlus™ Analysis of Five Samples at Three Loci (D3S1358, vWA and FGA). Which suspect is a possible source of the blood? Boxes immediately below the peaks label the name of the alleles seen while boxes below indicate their heights in RFUs



However, other cases are not so clearcut. Consider the electropherogram in Figure 3, which shows the DNA test results that purportedly "matched" a defendant to a saliva sample taken from the breast of an alleged sexual assault victim. Although the laboratory report stated that the same alleles were found in both samples at these three loci, close examination of the electropherograms supports a significantly different conclusion. There are two additional "peaks" in the saliva sample that the laboratory failed to report — a peak labeled "12" (indicating allele 12) at locus D3S1358, and a peak labeled "OL Allele" (indicating a possible "off-ladder," or unclassified, allele) at locus FGA. The laboratory decided to ignore these two peaks and never mentioned them in its report. A defense lawyer who failed to examine the underlying test results

would never have known about them. However, they clearly complicate the interpretation of the evidence — raising the possibility, for example, that the DNA on the breast swab is from a person with alleles 12 and 17 at locus D3S1358, rather than just allele 17, which would exclude the defendant as a possible contributor.



Sources of ambiguity in STR interpretation

A number of factors can introduce ambiguity into STR evidence, leaving the results open to alternative interpretations. To competently represent an individual incriminated by DNA evidence, defense counsel must uncover these ambiguities, when they exist, understand their implications, and explain them to the trier-of-fact.

Mixtures. One of the most common complications in the analysis of DNA evidence is the presence of DNA from multiple sources. A sample that contains DNA from two or more individuals is referred to as a mixture. A single person is expected to contribute at most two alleles for each locus. If more than two peaks are visible at any locus, there is strong reason to believe that the sample is a mixture.

By their very nature mixtures are difficult to interpret. The number of contributors is often unclear. Although the presence of three or more alleles at any locus signals the presence of more than one contributor, it often is difficult to tell whether the sample originated from two, three, or even more individuals because the various contributors may share many alleles. If alleles 14, 15 and 18 are observed at a locus, they could be from two individuals, A and B, where A contributed 15 and B contributed 14, 18. Alternatively, A could have contributed 14, 15 while B contributed 15, 18, and so on. There might also be three contributors. For example A could have contributed 14, 15, while B contributed 15, 18 and C contributed 15. Many other combinations are also consistent with the findings. A study of one database of 649 individuals found over 5 million three-way combinations of individuals that would have shown four or fewer alleles across all 13 commonly tested STR loci.⁵

Some laboratories try to determine which alleles go with which contributor based on peak heights. They assume that the taller peaks (which generally indicate larger quantities of DNA at the start of the analysis) are associated with a "primary" contributor and the shorter peaks with a

"secondary" contributor. In Figure 4, for example, a laboratory analyst might conclude that alleles 15 and 18 in the left locus (D3S1358), and alleles 19 and 21 in the right locus (FGA) are associated with a primary contributor, while allele 16 in the left locus and alleles 22 and 25 in the right locus are associated with a secondary contributor. But these inferences are often problematic because a variety of factors, other than the quantity of DNA present, can affect peak height. Moreover, labs are often inconsistent in the way they make such inferences, treating peak heights as a reliable indicator of DNA quantity when doing so supports the government's case, and treating them as unreliable when it does not.

These interpretive ambiguities make it difficult, and sometimes impossible, to estimate the statistical likelihood that a randomly chosen individual will be "included" (or, could not be "excluded") as a possible contributor to a mixed sample. Defense lawyers should look carefully at the way in which laboratories compute statistical estimates in mixture cases because these estimates often are based on debatable assumptions that are unfavorable to the defendant.

FIGURE 4: PRESENCE OF MORE THAN TWO ALLELES AT A LOCUS INDICATES A MIXTURE.

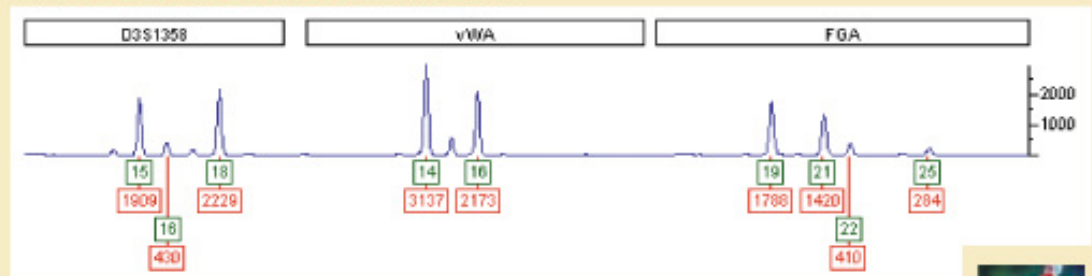
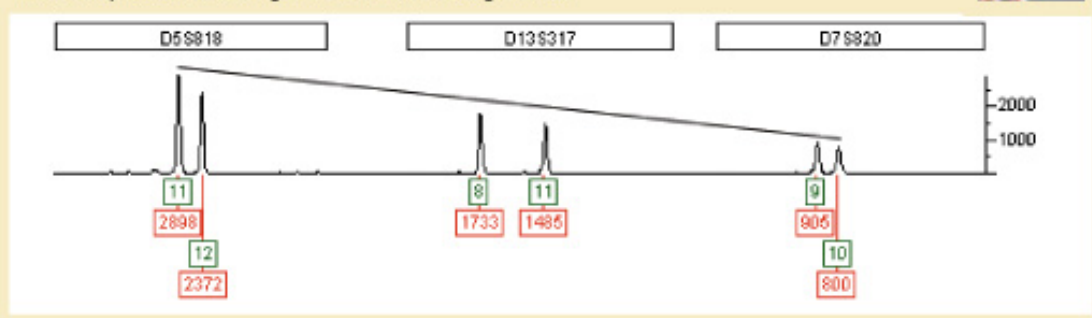


FIGURE 5: THE PROGRESSIVELY SMALLER PEAK HEIGHTS

In this sample from left to right are indicative of degradation



Degradation. As samples age, DNA like any chemical begins to break down (or degrade). This process occurs slowly if the samples are carefully preserved but can occur rapidly when the samples are exposed for even a short time to unfavorable conditions, such as warmth, moisture or sunlight.

Degradation skews the relationship between peak heights and the quantity of DNA present. Generally, degradation produces a downward slope across the electropherograms in the height of peaks because degradation is more likely to interfere with the detection of longer sequences of repeated DNA (the alleles on the right side of the electropherogram) than shorter sequences (alleles on the left side).

Degraded samples can be difficult to type. The process of degradation can reduce the height of some peaks, making them too low to be distinguished reliably from background "noise" in the data, or making them disappear entirely, while other peaks from the same sample can still be scored. In mixed samples, it may be impossible to determine whether the alleles of one or more contributors have become undetectable at some loci. Often analysts simply guess whether all alleles have been detected or not, which renders their conclusions speculative and leaves the

results open to a variety of alternative interpretations. Further, the two or more biological samples that make up a mixture may show different levels of degradation, perhaps due to their having been deposited at different times or due to differences in the protection offered by different cell types. Such possibilities make the interpretation of degraded mixed samples particularly prone to subjective (unscientific) interpretation.

Allelic Dropout. In some instances, an STR test will detect only one of the two alleles from a particular contributor at a particular locus. Generally this occurs when the quantity of DNA is relatively low, either because the sample is limited or because the DNA it contains is degraded, and hence the test is near its threshold of sensitivity. The potential for allelic dropout complicates the process of interpretation because analysts must decide whether a mismatch between two profiles reflects a true genetic difference or simply the failure of the test to detect all of the alleles in one of the samples.

FIGURE 6: ALLELIC DROPOUT OR THE WRONG MAN?

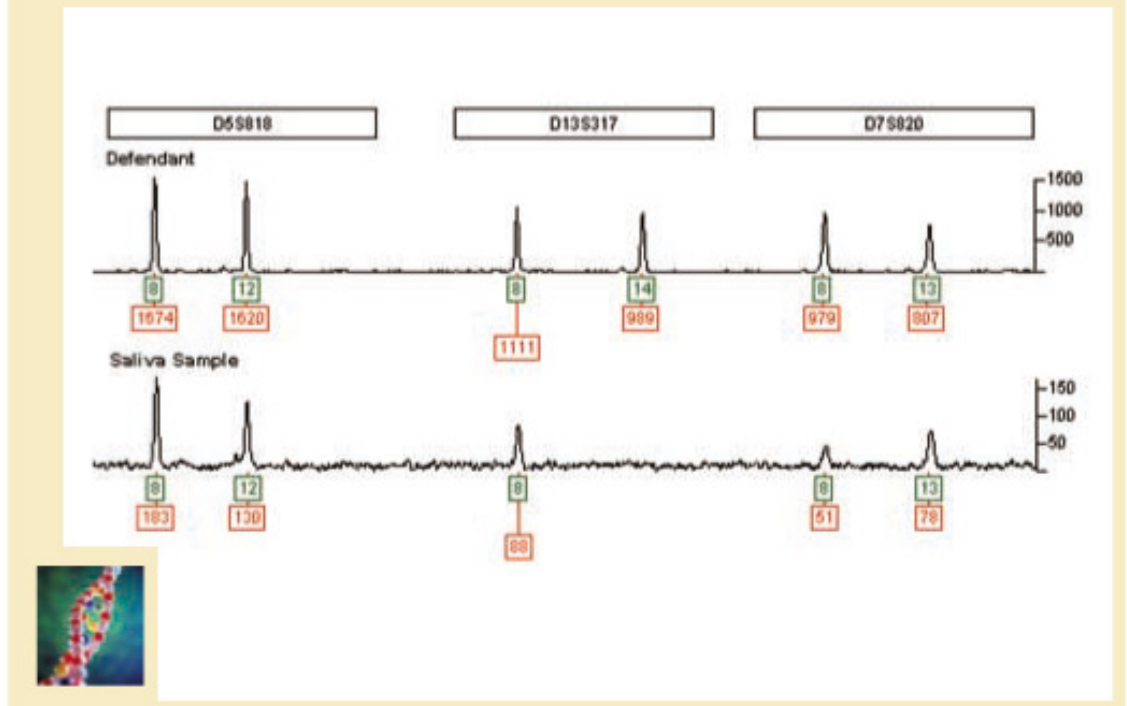


Figure 6 shows three additional loci from the case shown in Figure 3, in which a defendant's profile was "matched" to the profile of a saliva sample from a woman's breast. The laboratory reported that the DNA profile of the saliva sample shown in Figure 6 was consistent with the defendant's profile, despite the absence of the defendant's 14 allele at locus D13S317 because it assumed that the 14 allele had "dropped out." However, the occurrence of "allelic dropout" cannot be independently verified — the only evidence that this phenomenon occurred is the "inconsistency" that it purports to explain. Obviously, there is another possible interpretation that is more favorable for this defendant — i.e., that police arrested the wrong man.

Spurious Peaks. An additional complication in STR interpretation is that electropherograms often exhibit spurious peaks that do not indicate the presence of DNA. These extra peaks are referred to as "technical artifacts" and are produced by unavoidable imperfections of the DNA analysis process. The most common artifacts are stutter, noise and pull-up.

Stutter peaks are small peaks that occur immediately before (and, less frequently, after) a real peak. Stutter occurs as a by-product of the process used to amplify DNA from evidence samples. In samples known to be from a single source, stutter is identifiable by its size and position. However, it is sometimes difficult to distinguish stutter bands from a secondary

contributor in samples that contain (or might contain) DNA from more than one person.

"Noise" is the term used to describe small background peaks that occur along the baseline in all samples. A wide variety of factors (including air bubbles, urea crystals, and sample contamination) can create small random flashes that occasionally may be large enough to be confused with an actual peak or to mask actual peaks.

Pull-up (sometimes referred to as bleed-through) represents a failure of the analysis software to discriminate between the different dye colors used during the generation of the test results. A signal from a locus labeled with blue dye, for example, might mistakenly be interpreted as a yellow or green signal, thereby creating false peaks at the yellow or green loci. Pull-up can usually be identified through careful analysis of the position of peaks across the color spectrum, but there is a danger that pull-up will go unrecognized, particularly when the result it produces is consistent with what the analyst expected or wanted to find.

Although many technical artifacts are clearly identifiable, standards for determining whether a peak is a true peak or a technical artifact are often rather subjective, leaving room for disagreement among experts. Furthermore, analysts often appear inconsistent across cases in how they apply interpretive standards — accepting that a signal is a "true peak" more readily when it is consistent with the expected result than when it is not. Hence, these interpretations need to be examined carefully.

Spikes, blobs and other false peaks. A number of different technical phenomena can affect genetic analyzers, causing spurious results called "artifacts" to appear in the electropherograms. Spikes are narrow peaks usually attributed to fluctuation in voltage or the presence of minute air bubbles in the capillary. Spikes are usually seen in the same position in all four colors. Blobs are false peaks thought to arise when some colored dye becomes detached from the DNA and gets picked up by the detector. Blobs are usually wider than real peaks and are typically only seen in one color. The "OL Allele" shown in Figure 8 below may be a blob.

FIGURE 7: ELECTROPHEROGRAM

Contains technical artifacts called stutter that may mask the presence of true alleles present in an evidence sample

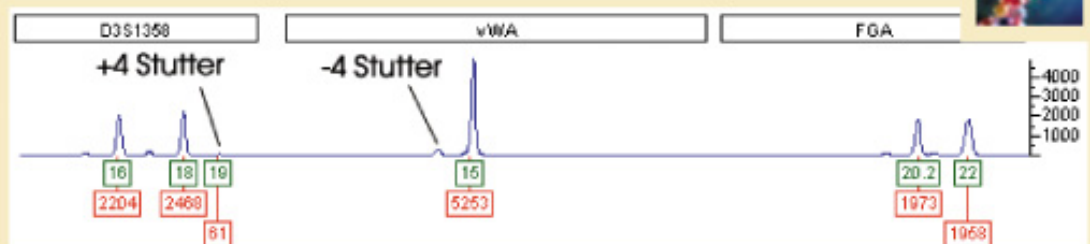
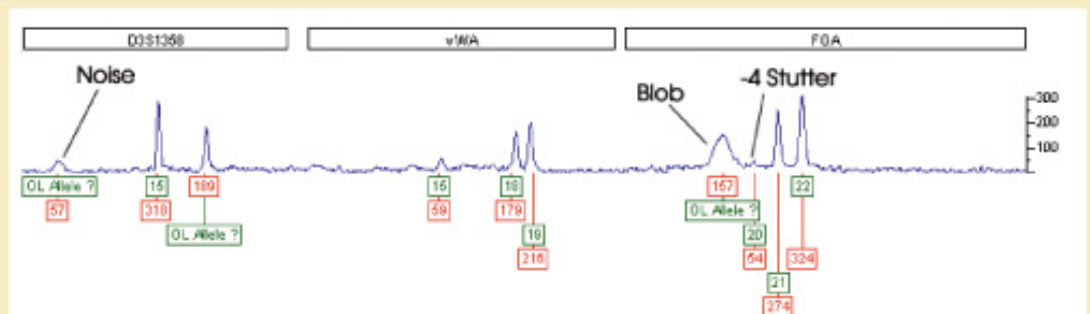


FIGURE 8: BLOBS AND OTHER FALSE PEAKS

May hide the presence of true alleles



Spikes and blobs are not reproducible, which means that if the sample is run through the genetic analyzer again these artifacts should not re-appear in the same place. Hence, the correct way to

confirm that a questionable peak is an artifact is to rerun the sample. However analysts, to save time, often simply rely on their "professional experience" to decide which results are spurious and which are real. This practice can be problematic because no generally accepted objective criteria have yet been established to discriminate between artifacts and real peaks (other than retesting).

Threshold Issues: Short Peaks, "Weak" Alleles. When the quantity of DNA being analyzed is very low (as indicated by low peak-heights) the genetic analyzer may fail to detect the entire profile of a contributor. Furthermore, it may be difficult to distinguish true low-level peaks from technical artifacts. Consequently, most forensic laboratories have established peak-height thresholds for "scoring" alleles. Only if the peak-height (expressed in RFU) exceeds a standard value will it be counted.

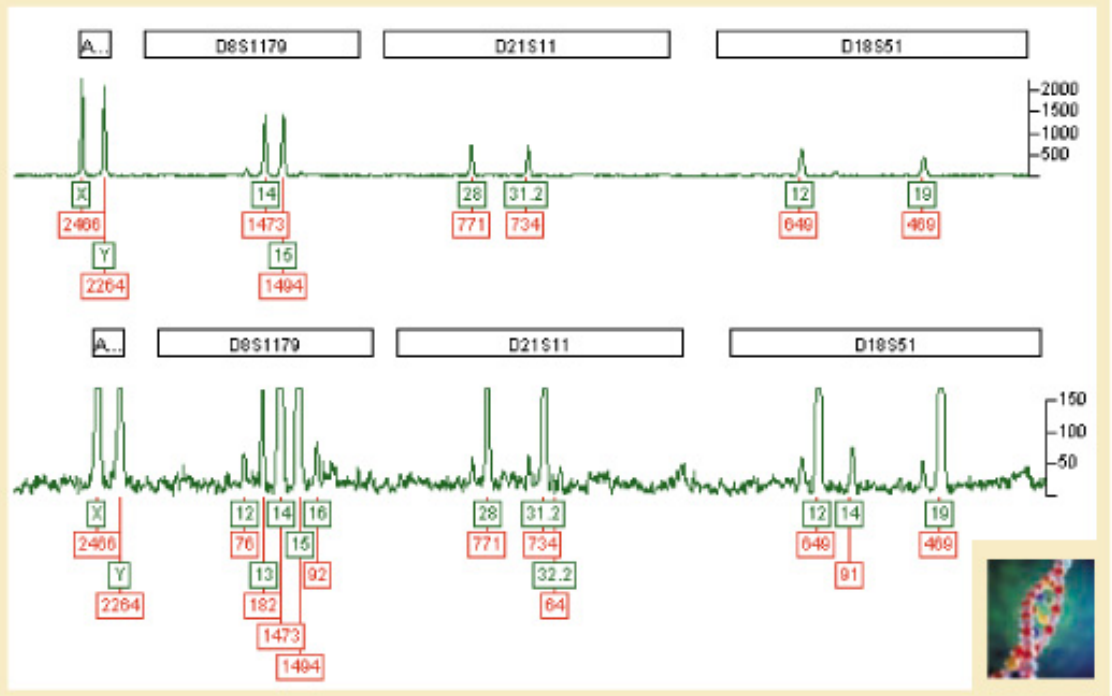
There are no generally accepted thresholds for how high peaks must be to qualify as a "true allele." Applied Biosystems, Inc., which sells the most widely used system for STR typing (the ABI Prism 310 Genetic Analyzer™ with the ProfilerPlus™ system) recommends a peak-height threshold of 150 RFU, saying that peaks below this level must be interpreted with caution. However, many crime laboratories that use the ABI system have set lower thresholds (down to 40 RFU in some instances). And crime laboratories sometimes apply their standards in an inconsistent manner from case to case or even within a single case. Hence, a defendant may be convicted in one case based on "peaks" that would not be counted in another case, or by another lab. And in some cases there may be unreported peaks, just below the threshold, that would change the interpretation of the case if considered.

Finding and evaluating low-level peaks can be difficult because labs can set their analytic software to ignore peaks below a specified level and can print out electropherograms in a manner that fails to identify low-level alleles. The best way to assess low-level alleles is to obtain copies of the electronic data files produced by the genetic analyzer and have them re-analyzed by an expert who has access to the analytic software.

Figure 9 shows electropherograms from a rape/homicide case. The defendant admitted having intercourse with the victim, but contended another man had subsequently raped and killed her. The crime lab reported finding only the defendant's profile in vaginal samples from the victim; the lab report stated that the second man was "excluded" as a possible source of the semen collected from the victim's body. However, a review of the electronic data by a defense expert revealed low-level alleles (peaks) consistent with those of the second man, which significantly helped the defense case. Notice how these low-level alleles are obscured in the upper electropherogram (which the lab initially provided in response to a discovery request) due to the use of a large scale (0-2000 RFU) on the Y-axis. These low peaks are revealed in the lower electropherogram, where the defense expert set the software with a lower threshold of detection and produced an electropherogram with a lower scale (0-150 RFU).

FIGURE 9: DEFENSE EXAMINATION OF ELECTRONIC DATA

Reveals Second Contributor to Vaginal Sample (After Crime Lab Reported the Second Man Had Been "Excluded")



Notes

1. Bureau of Justice Statistics, Survey of DNA Crime Laboratories, 2001. National Institute of Justice, NCJ 191191, January 2002. <<http://www.ojp.usdoj.gov/bjs/pub/pdf/sdnacl01.pdf>>
2. See, William C. Thompson, Subjective interpretation, laboratory error and the value of DNA evidence: Three case studies, 96 *Genetica* 153 (1995); William C. Thompson, Accepting Lower Standards: The National Research Council's Second Report on Forensic DNA Evidence. 37 *Jurimetrics* 405 (1997); William C. Thompson, Examiner Bias in Forensic RFLP Analysis, *Scientific Testimony: An Online Journal*, www.scientific.org.
3. See D. Michael Risinger, Michael J. Saks, William C. Thompson, & Robert Rosenthal, The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion. 90 *Cal.L.Rev.* 1 (2002).
4. For more background information on STR testing, see John M. Butler, *Forensic DNA Typing: Biology and Technology Behind STR Markers* (2001).
5. For more information about this study, contact Dan Krane.

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Evaluating Forensic DNA Evidence, Part 2

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Breaking open the black box: How to review the electronic data

Reviewing the electronic files produced by the ABI Prism 310 Genetic Analyzer™ (or similar equipment) has a number of additional benefits beyond revealing unreported low-level peaks. The software that controls these devices creates a complete record of all operations the device performs while typing samples in a particular case and records the results for each sample.

These records can reveal a variety of problems in testing that a forensic laboratory may fail to notice or choose not to report, such as failure of experimental controls, multiple testing of samples with inconsistent results, re-labeling of samples which can flag potential sample mix-ups and failure to follow proper procedures. We know of several cases in which review of electronic data has revealed that the laboratory failed to run all of the necessary control samples needed to verify the reliability of the test results, or that the laboratory ran the control samples under different conditions than the analytical samples (a major breach of good scientific practice).

The electronic files are also useful for producing trial exhibits. An expert with the right software can convert the files from their proprietary format into Adobe Acrobat™ files containing images that can easily be inserted into Powerpoint™ and Microsoft Word™ documents.

It is easy for crime laboratories to produce the electronic data that underlie their conclusions. All that is necessary is to copy the files produced in the case onto a CD-ROM or other storage medium. CD-ROMs are generally preferred because they create an unalterable record of the data produced by the laboratory. Copying files to a CD-ROM is a simple point and click operation that can be accomplished in fifteen minutes or less in most cases. CD-ROM burners compatible with any laboratory computer are available commercially for under \$200. There is no legitimate excuse for refusing to turn over electronic data for defense review. In a few instances laboratories have resisted producing electronic files, or have even destroyed the files, but the great majority of trial courts will not tolerate such obstructive behavior.

The electronic data produced by the ABI 310 Genetic Analyzer™ is in a proprietary format that can only be read and interpreted by ABI's Genescan™ and Genotyper™ software. Defense lawyers seeking a review of electronic data must find an expert who has access to this software. The review process typically takes a minimum of 3-4 hours, and may take much longer in an even moderately complicated case. Another option is provided by a company called Forensic Bioinformatics (www.bioforensics.com), which can analyze electronic data using an "expert system" software tool called Genophiler™. Genophiler, which was developed by the authors of this article, automates Genescan™ and Genotyper™ analysis, presents convenient summaries

of the analyzed data, and identifies and flags many of the technical issues discussed in this article.

Are there innocent explanations for the lab's findings?

In many cases, careful review of the underlying laboratory notes, electropherograms and electronic data will reveal no significant problems. Defense lawyers should never forget, however, that even clear-cut **DNA** test results may have innocent explanations.

Sample handling errors. Accidental mix-up or mislabeling of samples is a possibility that always must be considered. We have encountered a number such errors while reviewing case work.¹ In most instances the mix-ups readily come to light (and are caught by the lab) because they produce unexpected results: Samples that are supposed to be from a man show a female **DNA** profile, two samples known to be from the same person show different **DNA** profiles, and so on. The real danger arises when sample mix-ups produce plausible results. In these instances, forensic analysts may overlook subtle clues that something is amiss because they expected to find the very result produced by their error.

For example, after reviewing the laboratory notes in a Philadelphia rape case, one of the authors noticed some clues (later confirmed by additional testing) that the Philadelphia Police Crime Laboratory had mixed up the reference samples of the defendant and the rape victim. This mix up had falsely incriminated the defendant because the lab found what it thought was the defendant's **DNA** profile in a vaginal swab from the victim. In fact, it was the victim's own profile, and was mistakenly matched to the defendant due to the mix up.² Similar errors have come to light in other cases. Cellmark Diagnostics mistakenly mixed up the victim and defendant in a San Diego rape case, thereby mistakenly incriminating the defendant.³

A similar error occurred in Las Vegas, where a mix up involving reference samples of two men sent one man to jail for a rape committed by the other. The innocent man had been incarcerated for over a year when the error came to light in April, 2002.⁴ In both cases the error came too light only after a defense expert noticed inconsistencies in the laboratory records.

It is not always possible to tell from the laboratory records whether samples *actually* were mixed up or cross-contaminated. However, careful review of the laboratory records will usually provide important information about whether such errors *could have happened*. For example, evidence that a reference sample from the defendant was handled or processed in close proximity to samples from the crime scene can support the theory that a sample handling error explains incriminating results. In one case, review of a criminalist's notes showed that the defendant's trousers, collected at his home, were transported to the laboratory in the same box that contained a number of items from the crime scene that were saturated with the victim's blood. This fact cast important new light on a seemingly incriminating result: blood from victim was detected on the defendant's trousers.

We suggest that defense lawyers obtain and review complete copies of all records related to evidentiary samples collected in the case (see Appendix for a model discovery request). It should be possible to document the complete history of every sample from the time it was initially collected through its ultimate disposition.

*Inadvertent transfer of **DNA***

One of the most striking developments in forensic **DNA** testing in recent years is the testing of ever smaller biological samples. Whereas the original **DNA** tests required a fairly large amount of biological materials to get a result (e.g., a blood stain the size of a dime), current **DNA** tests are so sensitive that they can type the **DNA** found in samples containing only a few cells. There is likely to be enough of your **DNA** on the magazine you are reading right now for your **DNA** profile to be determined by a crime lab.

The increasing sensitivity of **DNA** tests has affected the nature of criminal investigations and has created a new class of **DNA** evidence. Analysts talk of detecting "trace **DNA**," such as the minute quantities of **DNA** transferred through skin contact. **DNA** typing is currently being

applied, with varying degrees of success, to samples such as doorbells pressed in home invasion cases, eyeglasses found at a crime scene, handles of knives and other weapons, soda straws, and even single fingerprints.

These developments will bring more **DNA** evidence to court in a wider variety of cases and may well open new lines of defense. A key issue will be the potential for inadvertent transfer of small amounts of **DNA** from one item to another, a process that could easily incriminate an innocent person. Studies have documented the presence of typeable quantities of human **DNA** on doorknobs, coffee cups and other common items.⁵

Studies have also documented the inadvertent transfer of human **DNA** from one item to another.⁶ *Primary transfer* occurs when **DNA** is transferred from a person to an item. *Secondary transfer* is when the **DNA** deposited on one item is transferred to a second item. *Tertiary transfer* is when the **DNA** on the second item is, in turn, transferred to a third. There are published studies that document secondary transfer of **DNA** (in quantities that can be detected by STR tests) from items that people simply touched to other items.

A recent study commissioned by a wealthy defendant was used to show that tertiary transfer of **DNA** could have occurred in a manner that falsely incriminated the defendant. Dr. Dirk Greineder, a prominent physician and adjunct Harvard professor, was accused of killing his wife. A **DNA** profile similar to Greineder's was found, mixed with his wife's profile, on gloves and a knife found near the crime scene. Greineder denied touching these items, which appeared to have been used by the killer. But how did his **DNA** get on them? Greineder offered a two-pronged defense.

First, he challenged the conclusion that his **DNA** matched that on the gloves, noting inconsistencies between his profile and the profile on the gloves. The crime laboratory had shifted its threshold for scoring alleles in a manner that allowed it to count alleles that matched with Greineder, while ignoring some that did not. And the lab had to evoke the theory of "allelic drop out" to explain why some of Greineder's alleles were not found.

Greineder's second line of defense is our focus here. He argued that his **DNA** could have gotten onto the glove through tertiary transfer. He and his wife had shared a towel the morning of the murder — perhaps his DNA was transferred from his face to the towel, and from the towel to his wife's face. His wife was later attacked by a glove-wearing stranger who struck her on the face, strangled her, and stabbed her, in the process transferring Greineder's DNA from his wife's face to the gloves and the knife. According to this theory, the tell-tale extra alleles on the gloves and knife that matched neither Greineder nor his wife were those of the killer.

To support the theory that his **DNA** could have been transferred innocently to the instruments of murder, Greineder commissioned a study. Forensic scientists Marc Taylor and Elizabeth Johnson, of Technical Associates (an independent laboratory in Ventura, California) simulated the sequence of events posited by the defense theory: A man wiped his face with a towel, then a woman wiped her face with the towel, then gloves and a knife like those used in the murder were rubbed against the woman's face. **DNA** tests on the gloves and knife revealed a mixture of **DNA** from the man and woman — exactly what was found in the Greineder case.⁷ Taylor was allowed to present his findings to the jury. Although the jury ultimately convicted Greineder (there was other incriminating evidence besides the DNA) the case is a good example of how the amazing sensitivity of contemporary DNA profiling methods facilitate a plausible explanation for what might at first seem to be a damning DNA test result.

Finding experts

The complexity of short tandem repeat (STR) testing makes it difficult if not impossible for a lawyer to evaluate the evidence without expert assistance. Defense lawyers generally need expert assistance to look behind the laboratory report and evaluate whether its conclusions are fully supported by the underlying data. Defense lawyers may also need expert assistance to develop and assess alternative theories of the evidence. Experts can also be helpful, and often are necessary, to assess whether laboratory error or inadvertent transfer of **DNA** might plausibly

account for the incriminating results.

In our experience, the best experts for evaluating whether the lab's findings are supported by the underlying data are academic scientists in the fields of molecular biology, biochemistry, bioinformatics, molecular evolution, genetics (particularly human and population genetics), and related fields. It is not essential that the expert have had experience analyzing forensic samples. In fact, we find that forensic scientists often (but not always) make poor defense experts because they tend to accept too readily the goal-directed subjective judgments and circular reasoning of their crime lab colleagues.

Academic scientists generally have much stronger training in scientific methods and, as a result, demand that test results be interpreted in a scientifically rigorous and unbiased manner. They often are appalled at the willingness of some forensic scientists to rely on subjective judgment and guesswork to resolve ambiguities in scientific data and their unwillingness to utilize blind procedures when making such judgments.

Having the electronic data analyzed by a company like Forensic Bioinformatics (www.bioforensics.com) is a good first step and can make it easier to work with an expert. Such automated analyses eliminate the need for the expert to do several hours of tedious work that requires specialized software, making it possible for the expert to get to the heart of the matter more quickly. They also highlight potential issues and problems that the attorney can use to get the interest of an expert.

Conclusions

Careful review of **DNA** evidence can reveal a variety of potential weaknesses, making it possible in some cases to challenge the government's conclusions and offer alternative interpretations. In order to provide effective representation to a client incriminated by **DNA** evidence, the defense attorney must do more than simply read the laboratory's conclusions. It is important to obtain and review the underlying scientific records, including electronic data, in order to determine whether the laboratory's conclusions are fully supported by the test results. It is also important to evaluate alternative explanations for the test results, to determine whether there are plausible innocent explanations. Promoters of **DNA** testing have effectively used the media to convince most people, including potential jurors, that the tests are virtually infallible. As **DNA** testing becomes more common in the justice system, it is vital that defense lawyers give it careful scrutiny in order to detect and expose those cases where genetic evidence deserves less weight than it is otherwise likely to receive.

Notes

1. See, William C. Thompson, Franco Taroni, and Colin G. Aitken, *How the probability of a false positive affects the value of **DNA** evidence*, J. Forensic Sci. (January 2003, in press).
2. See *Id.* for further discussion of this case. Copies of the laboratory reports may be obtained from William C. Thompson.
3. *Id.*
4. Glen Puit, ***DNA** Evidence: Officials admit error, dismiss case. LV lab put wrong name on sample*, Las Vegas Review-Journal, April 18, 2002.
5. See, van Oorschot ***DNA** fingerprints from fingerprints*, Nature, June 19, 1997, 767; Findlay, *et al.*, ***DNA** fingerprinting from single*

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How the Probability of a False Positive Affects the Value of DNA Evidence

ABSTRACT: Errors in sample handling or test interpretation may cause false positives in forensic DNA testing. This article uses a Bayesian model to show how the potential for a false positive affects the evidentiary value of DNA evidence and the sufficiency of DNA evidence to meet traditional legal standards for conviction. The Bayesian analysis is contrasted with the “false positive fallacy,” an intuitively appealing but erroneous alternative interpretation. The findings show the importance of having accurate information about both the random match probability and the false positive probability when evaluating DNA evidence. It is argued that ignoring or underestimating the potential for a false positive can lead to serious errors of interpretation, particularly when the suspect is identified through a “DNA dragnet” or database search, and that ignorance of the true rate of error creates an important element of uncertainty about the value of DNA evidence.

KEYWORDS: forensic science, DNA typing, statistics, Bayes theorem, likelihood ratio, error rate, false positive, proficiency testing, prosecutor’s fallacy, database, DNA dragnet

When evaluating the strength of DNA evidence for proving that two samples have a common source, one must consider two factors. One factor is the probability of a coincidental match (sometimes called the random match probability). A coincidental match occurs when two different people have the same DNA profile. The second factor is the probability of a false positive. A false positive (as we use that term here) occurs when a laboratory erroneously reports a DNA match between two samples that actually have different profiles. A false positive might occur due to error in the collection or handling of samples, misinterpretation of test results, or incorrect reporting of test results (1–3). Either a coincidental match or a false positive could cause a laboratory to report a DNA match between samples from different people. Consequently, one must consider both the random match probability and the false positive probability in order to make a fair evaluation of DNA evidence.

Although both factors affect the value of a reported match, forensic scientists and courts have been far more concerned about having a solid scientific basis for determining random match probabilities than for determining false positive probabilities. Efforts to establish rates of laboratory error through empirical study have, to date, received relatively little attention compared to efforts to establish the frequency (and hence the random match probability) of DNA profiles (4). When DNA evidence is presented in court, juries typically receive statistical data on the probability of a coincidental match (5,6). For example, a jury might be told “that the probability of selecting an unrelated individual at random from the population

having a DNA profile matching [the defendant’s] [is] approximately 1 in 351,200 blacks and approximately 1 in 572,000 Caucasians” (7). But juries rarely hear statistics on the frequency or probability of false positives (5,6).

Courts in many jurisdictions refuse even to admit evidence of a DNA match unless it is accompanied by statistical estimates of the random match probability, and they require that these statistics be computed in a manner that is valid and generally accepted by the scientific community (6). By contrast, no court has rejected DNA evidence for lack of valid, scientifically accepted data on the probability of a false positive (5,6). It is considered essential to know, with a high degree of scientific certainty, whether the frequency of random matches is 1 in 1,000, 1 in 10,000, or one in one million, but unnecessary to have comparable estimates on the frequency of false positives.

Why are the two possible sources of error in DNA testing treated so differently? In particular, why is it considered essential to have valid, scientifically accepted estimates of the random match probability but not essential to have valid, scientifically accepted estimates of the false positive probability?

In this article we will consider several possible explanations for the difference. We will argue that it arises, in part, from failure to appreciate the importance of the false positive probability for determining the value of DNA evidence. We will present a framework for considering the role that error may play in determining the probative value of forensic DNA evidence. We will show that even a small false positive probability can, in some circumstances, be highly significant, and therefore that having accurate estimates of the false positive probabilities can be crucial for assessing the value of DNA evidence.

Errors Happen

When DNA evidence was first introduced, a number of experts testified that false positives are impossible in DNA testing (6,8). This claim is now broadly recognized as wrong in principle

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(1,9–12), and it has repeatedly proven wrong in practice (3,13,14). But it has been repeated frequently, without skepticism, in appellate court opinions (6,8).

Why did experts offer this questionable testimony? One commentator has suggested that avid proponents of DNA evidence sought to allay judicial concerns about the potential for error by engaging in “a sinister semantic game” (8). They were able to deny that a DNA test could produce an error by excluding consideration of human error in administering or interpreting the test. Sinister or not, it is misleading to exclude considerations of human error in DNA testing when humans are necessarily involved in the administration and interpretation of DNA tests. For those who must evaluate DNA evidence, it makes little difference what causes a false match; what matters is how often false matches might be expected (9,15).

False positives have occurred in proficiency tests (2,3,11,13,16) and in actual cases (14,17). For example, the Philadelphia City Crime Laboratory recently admitted that it had accidentally switched the reference samples of the defendant and victim in a rape case. The error led the laboratory to issue a report that mistakenly stated that the defendant was a potential contributor of what the analysts took to be “seminal stains” on the victim’s clothing (18). The report also stated that the defendant’s profile was “included” in a mixed sample taken from vaginal swabs. After the sample switch came to light, the laboratory reassessed the evidence and concluded that the “seminal stains” were actually bloodstains that matched the victim’s DNA profile and that the defendant was excluded as a potential contributor to the vaginal sample (19).

In 1995, Cellmark Diagnostics admitted that a similar sample-switch error had caused it to report, incorrectly, that a rape defendant’s DNA profile matched DNA found in vaginal aspirate from a rape victim. After the error came to light during the defendant’s trial, Cellmark issued a revised report that stated that the vaginal sample matched the victim’s own DNA profile and that the defendant was excluded as a potential donor (20).

False positives can also arise due to misinterpretation of test results. One such error led to the false conviction of Timothy Durham (14,17). In 1993, a Tulsa, Oklahoma jury convicted Durham of the rape of an eleven-year-old girl. He was sentenced to 3000 years in prison. The prosecution presented three pieces of evidence against him: the young victim’s eyewitness identification, testimony that Durham’s hair was similar (in microscopic examination) to hair found at the crime scene, and a DNA test (DQ-alpha) that reportedly showed that Durham’s genotype matched that of the semen donor. Durham presented eleven witnesses who placed him in another state at the time of the crime, but the jury rejected his alibi defense. Fortunately for Durham, post-conviction DNA testing showed that he did not share the DQ-alpha genotype found in the semen. He was also excluded at several other genetic loci in multiple tests. The initial DNA test result that helped convict Durham was proven to have been a false positive. The error arose from misinterpretation. The laboratory had failed to completely separate male from female DNA during differential extraction of the semen stain. The victim’s alleles, when combined with those of the true rapist, produced an apparent genotype that matched Durham’s. The laboratory mistook this mixed profile for a single source result, and thereby falsely incriminated an innocent man. Durham was released from prison in 1997 (14).

Although experience has shown that false positives can occur, the rate at which they occur is difficult to estimate on the basis of existing data. Most laboratories participate in periodic proficiency tests, which can cast some light on the potential for error. European

forensic laboratories have carried out collaborative exercises involving analysis of stains from known sources (21–26). However, this work is designed more to test the uniformity of DNA test results among laboratories using the same protocol than to determine the rate of errors. In the United States, TWGDAM guidelines call for each analyst to take two proficiency tests each year (27), and proficiency testing is a requirement for laboratory certification under the program administered by ASCLAD-LAB (28). However, these tests generally are not well designed for estimating the rate of false positives. The tests typically are not blind (i.e., the analysts know they are being tested), they involve limited numbers of samples, and the samples may be easier to analyze than those encountered in routine casework.

In 1992, a report of the National Research Council called for more extensive proficiency testing, declaring that “laboratory error rates must be continually estimated in blind proficiency testing and must be disclosed to juries” (1). The NRC called for external, blind proficiency tests “that are truly representative of case materials (with respect to sample quality, accompanying description, etc.).” Thereafter, the Federal DNA Identification Act of 1994 required the director of the National Institute of Justice (NIJ) to report to Congress on the feasibility of establishing an external blind proficiency testing program for DNA laboratories. But the move toward external blind proficiency testing lost momentum when the NIJ director raised a number of practical concerns. It was dealt another blow by the 1996 report of the National Research Council, which downplayed the need for proficiency testing. The 1996 NRC report suggested that the problem of laboratory error be addressed through a variety of means and concluded that the best way to safeguard against error is to allow re-testing of samples (28).

Do We Need Scientifically Valid Estimates of Laboratory Error Rates?

Although re-testing is undoubtedly helpful, it does not eliminate the need to consider error when evaluating DNA evidence. Re-testing cannot catch every error. A critical error, such as cross-contamination of samples, may occur before samples can be split for duplicate testing (29,30). Some errors, such as the error of interpretation that falsely incriminated Timothy Durham, may simply be repeated on re-test. And re-testing cannot be done in every case because critical samples are sometimes exhausted by the first test. Re-testing may reduce the likelihood of a false positive, but no one claims that it can eliminate false positives. Hence, the availability of re-testing does not by itself explain why less importance is placed on having accurate estimates of false positive probabilities than random match probabilities.

Another explanation, suggested by some court opinions, is that jurors have less need of statistical estimates when evaluating the probability of a false positive because they can appreciate the potential for false positives based on common sense and experience. “Shortcomings such as mislabeling, mixing the wrong ingredients, or failing to follow routine precautions against contamination may well be amenable to evaluation by jurors without the assistance of expert testimony” (31). By contrast, there is nothing in jurors’ everyday experience that would allow them to estimate the probability of a coincidental match between two DNA profiles; hence, experts must present statistical estimates of the random match probability.

The problem with this argument is that it equates the ability to appreciate the potential for a laboratory error with the ability to accurately estimate the probability of an error. It is not clear that the latter will necessarily follow from the former. Even if jurors un-

derstand the various ways in which a false positive might occur, it requires a leap of faith to conclude that they will therefore be able to determine accurately, based on common sense, whether, for example, the probability of such an error in a particular case is 1 in 100 or 1 in 10,000. In the absence of solid empirical data there is considerable disagreement among experts about what the rate of laboratory error might be (3,8,13,15,16). To rely on jurors' common sense to produce accurate estimates when experts cannot agree seems unduly optimistic.

It might be argued, however, that jurors do not need precise estimates of the false positive probability—they need only know that the probability of error is low enough to make a false positive unlikely in the case at hand. If, as commentators have suggested, the rate of false positives is between 1 in 100 and 1 in 1000, or even less (3,8,12,13,16), then one might argue that the jury can safely rule out the prospect that the reported match in their case is due to error and can proceed to consider the probability of a coincidental match. For reasons we will explain more fully below, this argument is fallacious and profoundly misleading. The core of the fallacy is the erroneous assumption that the false positive probability, which is the probability that a match would be reported *between two samples that do not match*, is equal to the probability that a false match was reported in a particular case. As we will explain below, the probability that a reported match occurred due to error in a particular case can be much higher, or lower, than the false positive probability.

How the Potential for Error Affects the Value of DNA Evidence

We now present a framework for considering the role that error may play in determining the value of DNA evidence. Our approach relies on Bayes' theorem, a basic principle of logic. Bayes' theorem indicates how a rational evaluator should adjust a probability assessment in light of new evidence (32–34). Our analysis shows how the probability of a false positive should influence a rational evaluator's belief in the proposition that a particular individual is the source of a biological specimen. We use Bayes' theorem here solely to illustrate the logical connection between the false positive rate and the value of DNA evidence. We do not address the separate issue of whether Bayes' theorem should be used to explain the value of DNA evidence to juries.

Suppose that a rational evaluator is considering whether a biological specimen could have come from a particular suspect. The evaluator must assess the probability of two alternative propositions:

- \underline{S} : the specimen came from a suspect;
- \bar{S} : the specimen did not come from a suspect.

The evidence to be evaluated is a forensic scientist's report of a DNA match between the suspect's profile and the profile of the sample. We will call the report of a match R . Under the conventional expression of Bayes' theorem:

$$\frac{P(S | R)}{P(\bar{S} | R)} = \frac{P(S)}{P(\bar{S})} \cdot \frac{P(R | S)}{P(R | \bar{S})} \quad (1)$$

Bayes' theorem describes the relationship between three components: the prior odds, the posterior odds, and the likelihood ratio. The term to the immediate right of the equal sign is the prior odds, which reflect the evaluator's assessment of the odds that a proposition is true before the receipt of new evidence. The term to the left of the equal sign is the posterior odds, which reflect the evaluator's belief in the odds that the proposition is true after receipt of new evi-

idence. The remaining term, to the right of the multiplication sign, is the likelihood ratio. It specifies the evaluator's belief in the relative probability that the new evidence would arise if the proposition is true and if it is not true. Bayes' theorem specifies that the posterior odds of a proposition equal the prior odds multiplied by the likelihood ratio.

Bayes' theorem can be used to show the effect that DNA evidence should have on belief in the propositions S and \bar{S} . Suppose, for example, that the evaluator initially (before considering the DNA evidence) thinks there is a 20% chance that the suspect is the source of a specimen. In terms of Eq 1, $P(S) = 0.20$ and $P(\bar{S}) = 0.80$. Therefore, the prior odds would be 0.25 (often expressed as 1:4 odds). Suppose further that the evaluator thinks the match is certain to be reported if the suspect was the source of the specimen, hence $P(R | S) = 1.00$, and the evaluator thinks that there is only one chance in 1000 that a match would be reported if the suspect was not the source of the specimen, hence $P(R | \bar{S}) = 0.001$. Accordingly, the likelihood ratio is $1.00/0.001 = 1000$. To determine the posterior odds, one simply multiplies the prior odds by the likelihood ratio; hence the posterior odds should be $0.25 \cdot 1000 = 250$. In other words, the evaluator should now believe that proposition S is 250 times more likely than proposition \bar{S} .

The conclusion can be restated as a probability by simply converting the posterior odds to a probability using the formula: Probability = Odds/(Odds + 1). Thus, one can say that the evaluator should now believe the probability that the suspect is the source of the specimen is $250/251 = 0.996$. In other words, if the evaluator believes that the DNA evidence is 1000 times more likely to arise under S than under \bar{S} , then the evaluator should revise his estimated probability that the suspect is the source from 0.20 to 0.996 after receipt of the DNA evidence.

In the conventional expression of Bayes' theorem, the likelihood ratio takes into account all variables that affect the value of the evidence. The likelihood ratio for a reported DNA match is affected by both the probability of a random match and the probability of a false positive, because both factors contribute to the denominator of the likelihood ratio, $P(R | \bar{S})$. In order to assess the relative impact of the random match probability (RMP) and the false positive probability (FPP) on the value of DNA evidence, we must expand the likelihood ratio in order to show the separate effect of these two variables. As explained in the Appendix, the likelihood ratio can be expanded as follows:

$$\frac{P(R | S)}{P(R | \bar{S})} = \frac{1}{RMP + [FPP \cdot (1 - RMP)]} \quad (2)$$

Using this version of the likelihood ratio, it is easy to show how the potential for a false positive affects the value of DNA evidence. Table 1 shows how variations in the prior odds, random match probability, and false positive probability should affect a rational evaluator's assessment of the posterior odds that the suspect was the source of a biological specimen. The posterior odds presented in the table were calculated by multiplying the prior odds by the likelihood ratio as stated in Eq 2.

The prior odds presented in Table 1 are designed to correspond to four distinct case types that vary in how strongly the suspect is implicated as the source of the specimen by evidence other than the DNA match. Prior odds of 2:1 describe a case in which the other evidence is fairly strong but not sufficient, by itself, for conviction. It has been reported that DNA testing leads to the exclusion of approximately one third of suspects in sexual assault cases. Hence, prior odds of 2:1 might describe a typical sexual assault case submitted for DNA testing.

TABLE 1—Posterior odds that a suspect is the source of a sample that reportedly has a matching DNA profile, as a function of prior odds, random match probability, and false positive probability.

Prior Odds	Random Match Probability	Probability of a False Positive	Posterior Odds
2:1	10^{-9}	0	2 000 000 000
2:1	10^{-9}	0.0001	20 000
2:1	10^{-9}	0.001	2000
2:1	10^{-9}	0.01	200
2:1	10^{-6}	0	2 000 000
2:1	10^{-6}	0.0001	19 802
2:1	10^{-6}	0.001	1998
2:1	10^{-6}	0.01	200
2:1	10^{-3}	0	2000
2:1	10^{-3}	0.0001	1818
2:1	10^{-3}	0.001	1001
2:1	10^{-3}	0.01	182
1:10	10^{-9}	0	100 000 000
1:10	10^{-9}	0.0001	1000
1:10	10^{-9}	0.001	100
1:10	10^{-9}	0.01	10
1:10	10^{-6}	0	100 000
1:10	10^{-6}	0.0001	990
1:10	10^{-6}	0.001	100
1:10	10^{-6}	0.01	10
1:10	10^{-3}	0	100
1:10	10^{-3}	0.0001	91
1:10	10^{-3}	0.001	50
1:10	10^{-3}	0.01	9
1:100	10^{-9}	0	10 000 000
1:100	10^{-9}	0.0001	100
1:100	10^{-9}	0.001	10
1:100	10^{-9}	0.01	1
1:100	10^{-6}	0	10 000
1:100	10^{-6}	0.0001	99
1:100	10^{-6}	0.001	10
1:100	10^{-6}	0.01	1
1:100	10^{-3}	0	10
1:100	10^{-3}	0.0001	9
1:100	10^{-3}	0.001	5
1:100	10^{-3}	0.01	1
1:1000	10^{-9}	0	1 000 000
1:1000	10^{-9}	0.0001	10.0
1:1000	10^{-9}	0.001	1.0
1:1000	10^{-9}	0.01	0.1
1:1000	10^{-6}	0	1000
1:1000	10^{-6}	0.0001	9.9
1:1000	10^{-6}	0.001	1.0
1:1000	10^{-6}	0.01	0.1
1:1000	10^{-3}	0	1.00
1:1000	10^{-3}	0.0001	0.91
1:1000	10^{-3}	0.001	0.50
1:1000	10^{-3}	0.01	0.09

Prior odds of 1:10 and 1:100 describe cases in which the other evidence indicates a relatively low initial probability that the suspect is the source, as might occur if the match were found during a "DNA dragnet," in which the police tested many possible contributors in a particular locality with little reason to suspect any of them in particular other than their proximity to the crime. Prior odds of 1:1000 describe a case in which there is almost no evidence apart from the DNA match, as might occur in a "cold hit" case in which the suspect is selected by scanning a databank of thousands of people for matching DNA profiles.

The random match probabilities presented in Table 1 are chosen to represent a range of values that might plausibly arise in actual cases. Random match probabilities on the order of one in one bil-

lion (10^{-9}) are often reported when laboratories are able to match two single source samples over ten or more STR loci. Random match probabilities closer to one in one million (10^{-6}) are common when fewer loci are examined, when the laboratory can obtain only a partial profile of one of the samples, or when one of the samples contains a mixture of DNA from more than one person. Random match probabilities near 1 in 1000 (10^{-3}) often result from the use of less discriminating tests, such as DQ-alpha/polymarker, particularly when the comparison involves a mixed sample.

The false positive probabilities presented in Table 1 are also chosen to represent a plausible range that might arise in actual cases. Although the probability of a false positive in any particular case will depend on a variety of factors, commentators generally have estimated the overall rate of false positives to be between 1 in 100 (0.01) and 1 in 1000 (0.001) (8,13,16). Of course, these estimates may overstate the probability for cases in which special steps, such as repeat testing, have been taken to reduce the chance of error. So for purposes of illustration we also present a false positive probability of 1 in 10,000 (0.0001). If two independent tests comparing the same samples each had a false positive probability of 1 in 100, then the probability of a false positive on both tests would be 1 in 10,000. A false positive probability of zero is also included for purposes of comparison with the other values (although zero is not a plausible value for this variable).

As Table 1 shows, the posterior odds are strongly influenced by the prior odds, the random match probability, and the false positive probability. This result indicates that a rational evaluator should consider all three factors when assessing the likelihood that the suspect is the source of a particular sample.

One aspect of these results that may be counter-intuitive is that the importance of the false positive probability for determining the posterior odds varies dramatically depending on the value of the random match probability. As Table 1 shows, changes in the false positive probability have a much greater effect on the posterior odds when the random match probability is low than when it is higher. For example, when the random match probability is one in one billion (10^{-9}), the posterior odds diminish by five orders of magnitude when the false positive probability increases from 0 to 1 in 10,000. In contrast, when the random match probability is 1 in 1000 (10^{-3}) the same increase in the false positive probability produces only a small change (much less than one order of magnitude) in the posterior odds.

These results may seem counter-intuitive given that the false positive probability and the random match probability are combined in a manner that is approximately additive in Eq 2. However, the effect of changing one of these variables on the value of the likelihood ratio depends on the size of the change *relative to* the other variable. Receiving \$100 changes my net assets more dramatically if I started with \$1 than if I started with \$200. Similarly, an increase of given size in the false positive probability will affect the likelihood ratio more dramatically when the random match probability is very small than when it is larger. Hence, it may be far more important to have an accurate estimate of the probability of a false positive when evaluating a reported match on a rare DNA profile than when evaluating a reported match on a more common profile.

Another important lesson to be learned from Table 1 is that the posterior odds can be rather low notwithstanding an impressive random match probability. When the random match probability is one in one billion, for example, one might assume that the odds the suspect is the source of the sample will necessarily and always be very high. Not so. If the prior odds are 1:1000 because the suspect was selected by trawling through a large data bank to find a match-

ing profile, and there is little other evidence of his guilt, then the posterior odds will be only 10 if the false positive probability is 1 in 10,000, only 1.00 if the false positive probability is 1 in 1000, and only 0.10 if the false positive probability is 1 in 100. Hence, a rational evaluator who thought the false positive probability was between 1 in 100 and 1 in 1000 should conclude that the suspect probably is not the source of the sample, notwithstanding the reported match on a profile found in one person in a billion.

Posterior Odds and the Standard of Proof

One way to understand the posterior odds presented in Table 1 is to relate them to the traditional standard of persuasion in criminal trials. How high should the posterior odds be to convince a rational juror “beyond a reasonable doubt” that the suspect is the source of the sample?

A number of legal commentators have linked the criminal standard of persuasion to posterior odds (35). For example, Professor Richard Friedman (36) has argued that a rational adjudicator should treat an accused as guilty if and only if

$$Oy > \frac{Ep}{En} \quad (3)$$

where Oy is the odds of guilt, Ep is the social cost (disutility) of a false conviction, and En is the social cost (disutility) of a false acquittal. If one accepts Blackstone’s famous statement that “it is better that ten guilty persons escape, than that one innocent suffer” then, according to Friedman’s analysis, one should convict only if the posterior odds of guilt are at least 10:1 (37).

The United States Supreme Court has quoted with apparent approval Thomas Starkie’s statement that “it is better that ninety-nine . . . offenders should escape than that one innocent man should be condemned” (38). If one accepts Starkie’s statement, then the posterior odds of guilt should exceed 99:1 to justify conviction. Although there is no apparent consensus among experts on this issue, Ceci and Friedman (37) have recently argued that Blackstone’s ratio “understates” the correct legal standard for conviction and that Starkie’s ratio “appears closer to the mark.”

This analysis casts additional light on the data presented in Table 1. To appreciate what the data tell us about the strength of DNA evidence, we can consider the circumstances under which DNA evidence would meet the Blackstone and Starkie standard of proof. We are not proposing that these quantitative standards be employed in actual trials. We invoke these standards merely as a framework for understanding what the data in Table 1 tell us about the value of DNA evidence. In the discussion that follows, we will assume a hypothetical criminal case in which a laboratory reports a DNA match between a sample known to have come from the perpetrator and a reference sample from the defendant. We will assume that identity is the only issue in the case, and hence that the jurors should convict if they are convinced beyond a reasonable doubt that the defendant is the source of the sample. Under what circumstances should a rational jury convict the defendant?

When the prior odds are 2:1, the posterior odds are well above both the Blackstone and Starkie threshold for all levels of random match probability and false positive probability presented in Table 1. Because the case against the defendant is relatively strong even without the DNA evidence, the reported DNA match is sufficient to push a rational evaluator over the threshold of conviction even under the worst-case scenario in which both the random match probability (10^{-3}) and the false positive probability (0.01) are high.

When the prior odds are 1:10, the situation becomes more complicated. Here the other evidence against the defendant is weaker

and the DNA evidence must therefore be a bit stronger to push a rational evaluator across the threshold of conviction. For this type of case, the posterior odds are well above the Starkie threshold only when the random match probability is one in one million (10^{-6}) or less and the false positive probability is 1 in 10,000 or less. When the false positive probability is 1 in 100, the posterior odds are at or below the Blackstone threshold for all random match probabilities. Thus, for cases of this type, it appears very important to know whether the false positive probability might be as high as 1 in 100. If so, there is “reasonable doubt” about the defendant’s guilt.

When the prior odds are 1:100, the DNA evidence must be very powerful to justify conviction. The posterior odds barely meet the Starkie threshold when the random match probability is one in one million or less and the false positive probability is 1 in 10,000. The posterior odds exceed the Blackstone threshold only when the random match probability is one in one million or less *and* the false positive probability is 1 in 10,000 or less. For this type of case, it is again crucial to know the exact value of the false positive probability in order to determine whether the DNA is strong enough to justify conviction. If the false positive rate is as high as 1 in 1000, there is “reasonable doubt” about the defendant’s guilt.

In the weakest case, when the prior odds are 1:1000, DNA evidence is insufficient to meet the Starkie standard under any of the values listed in Table 1, except when the false positive probability is (unrealistically) assumed to be zero. Even when the random match probability is one in one billion and the false positive probability is 1 in 10,000, the posterior odds barely reach the Blackstone threshold. For a case of this type, a false positive probability of even 1 in 1000 should render the DNA evidence insufficient to justify conviction. Indeed, when the random match probability is 1 in 1000, a DNA match is insufficient even to prove that the suspect is more likely than not to be the source of the sample.

The False Positive Fallacy

The key conclusion to emerge from this analysis is the importance of having accurate information about *both* the random match probability and the false positive probability when evaluating DNA evidence. Ignoring or underestimating the potential for a false positive can lead to serious errors of interpretation, particularly when the other evidence against the suspect (apart from the DNA evidence) is weak.

We return therefore to the question raised at the beginning of this article. Why is it considered essential to have valid scientific data on the random match probability but unnecessary to have valid data on the false positive probability?

We believe the explanation lies partly in a common logical fallacy that we shall call the false positive fallacy. We suspect that people mistakenly assume that *if* the false positive probability is low *then* the probability of a false match must also be low in every case. For example, a forensic scientist who thinks that there is only a 1% chance (1 chance in 100) of falsely declaring a match between the samples in a case *if they really do not match*, might assume that there is, necessarily, a 99% chance (99 chances in 100) that the reported match is a true match. This assumption is fallacious, although the mistake is not easy to see.

The fallacy arises from mistakenly equating the conditional probability of a match being reported *when the samples do not match* (the false positive probability) with the probability that the samples do not match *when a match has been reported*. These two probabilities are not the same. The *false positive probability* is the probability of a match being reported under a specified condition (no match). It does not depend on the probability of that condition

occurring. By contrast, the probability that the samples do not match *when a match has been reported* depends on both the probability of a match being reported under the specified condition (no match) and on the prior probability that that condition will occur. Consequently, the probability that a reported match is a true match or a false match cannot be determined from the false positive probability alone.

In formal terms, the fallacious assumption is that $P(M \mid R) = 1 - P(R \mid \bar{M})$, where M is the event that the suspect and the perpetrator have matching DNA profiles, \bar{M} is the event that they do not have matching profiles, and $P(R \mid \bar{M})$ is the false positive probability, i.e., the probability of a match being reported given that the samples do not have matching profiles. This assumption is fallacious because it ignores the prior odds that the suspect's profile matches the sample profile. Let the prior odds, $P(M)/P(\bar{M})$, equal $1/k$ where k is large. Then:

$$\frac{P(M \mid R)}{P(\bar{M} \mid R)} = \frac{P(R \mid M)}{P(R \mid \bar{M})} \cdot \frac{1}{k} \quad (4)$$

Assume $P(R \mid M) = 1$. Then $P(M \mid R) = 1/[1 + k \cdot P(R \mid \bar{M})]$ which can be much lower than $1 - P(R \mid \bar{M})$ when k is large.

For example, suppose that the prior odds the suspect will match are 1:1000 because the suspect is selected through a large DNA dragnet and appears, initially, to be an unlikely perpetrator. Suppose further that a DNA match is reported and that the false positive probability is 0.01 (1 in 100). The probability that this reported match is a true match is, therefore, $1/[1 + 1000(0.01)] = 0.0999$. In other words, the probability that this reported match is a true match is not 0.99 (99 chances in 100), as the false positive fallacy would suggest; it is less than 0.1 (one chance in ten).

Thus, when the prior odds that a particular suspect will match are very low, as might be the case if the suspect is identified during a "DNA dragnet" or database search, the probability that the samples do not match when a match has been reported can be far higher than the false positive probability. For cases of this type, true matches are expected to be rare. Therefore, the probability in a particular case that a non-match will mistakenly be reported as a match, even if low, may approach or even surpass the probability that the suspect truly matches.

The false positive fallacy is similar in form to the well known "prosecutor's fallacy" (39), but differs somewhat in content. Victims of the false positive fallacy mistakenly assume that $P(M/R) = 1 - P(R/\bar{M})$. Victims of the prosecutor's fallacy mistakenly assume that $P(S/M) = 1 - P(M/\bar{S})$ (39). Both fallacies arise from failure to take account of prior probabilities (or odds) when evaluating new evidence; both can lead to significant overestimation of the posterior probability when the prior probability is low. The prosecutor's fallacy is an erroneous way of estimating the probability that the suspect is the source of a sample based on evidence of a matching characteristic; the false positive fallacy is an erroneous way of estimating the probability of a true match based on a reported match. It is important that forensic scientists, and others who evaluate DNA evidence, understand and appreciate both fallacies.

False Positives and Cold Hits

When first introduced, DNA testing was used primarily for "confirmation cases," that is, cases where other evidence pointed to a likely suspect (40). In recent years, the growing use of offender databanks and "DNA dragnets" has created a new class of cases, sometimes called "cold hit" or "trawl cases," in which the DNA match itself makes the defendant a suspect (40,41). In such cases

there may be little evidence against a suspect other than a DNA match.

The evidentiary value of "cold hit" DNA matches has been debated. The National Research Council, in reports on forensic DNA evidence issued in 1992 (1) and 1996 (28), argued that DNA matches obtained in database searches are less probative than those obtained when testing a previously identified suspect because the probability of finding a match by chance increases when one trawls through a database comparing large numbers of profiles.

However, statisticians David Balding and Peter Donnelly have argued persuasively from a Bayesian perspective that the likelihood ratio describing the value of a DNA match does not depend on the nature of the search that produced the match and hence that a cold hit is just as powerful as any other DNA match (assuming the same random match probability) (41). By their account, the strength of the overall case may sometimes be weak when the suspect was identified in a database search because the prior probability of guilt in such cases can be very low, but the trawl through the database does not diminish the probative value of the DNA match. In fact, they argue that a database DNA match may provide slightly stronger evidence of identity than a confirmation case match if, as typically happens, the search of the database rules out (excludes) a large number of other individuals while finding a match to only one (40,41).

The Balding and Donnelly analysis seems correct, as far as it goes. However, Balding and Donnelly acknowledge that they "ignore the possibility of handling or laboratory error leading to a 'false positive' match, although this possibility must be addressed in practice" (41). The analysis reported in the present article goes beyond that of Balding and Donnelly to demonstrate the implications of false positives for both confirmation and trawl cases and thereby casts important new light on the question of the evidentiary value of database matches.

The potential for false positives may be a particularly important consideration when evaluating DNA evidence in trawl cases where the prior probability that any particular suspect is the source of an evidentiary sample is very low. In such cases, a key issue is whether the DNA match is sufficiently probative to create a high posterior probability that the suspect is the source despite the low prior probability. The results reported in Table 1 suggest that the probability of a false positive may be a critical factor in determining whether the DNA evidence is indeed strong enough.

Consider, for example, the hypothetical cases illustrated in Table 1 in which the prior odds that the suspect is the source of an evidentiary sample are 1:1000 and the random match probability is one in one billion (10^{-9}). If the probability of a false positive is zero, then the posterior odds are a million to one in favor of the suspect being the source, which certainly seems high enough to justify confidence in that conclusion. In other words, the DNA evidence has more than enough probative value to make up for the low prior probability. However, if the false positive probability is even 1 in 10,000, the posterior odds in favor of the suspect being the source are reduced drastically to only 10:1. It is very important for those evaluating DNA evidence to understand that a false positive probability on the order of 1 in 10,000, which may seem low enough to be "safe," may nevertheless undermine the value of a one-in-a-billion DNA match sufficiently that, when combined with a low prior probability, there is still room for doubt about whether the suspect is the source of the matching sample.

Of course, the assessment of hypothetical cases cannot tell us whether, as a practical matter, the false positive probability could be as high as 1 in 10,000 in a given case. As Donnelly and Friedman have noted, "what matters is not the probability of any labora-

tory error, but rather only the probability of those errors that would lead to the false declaration of a match in the given case—a probability that will vary widely with the circumstances of the DNA testing” (40). The false positive probability is undoubtedly affected by such factors as the quality of laboratory work and the clarity of the results. Dangerous laboratory practices, such as handling and processing evidentiary and reference samples in close physical and temporal proximity, might increase the false positive probability. Loose interpretive standards that allowed a match to be called based on incomplete or problematic data might also increase the false positive probability. Fortunately, the particular circumstances of database searches would seem to rule out, or at least greatly reduce, the likelihood of some types of errors, such as those arising from switching or cross-contaminating samples, because samples are tested at different times and, often, in different laboratories. However, other types of errors, such as those arising from misinterpretation of test results, might still produce false matches. Whether the chance of a false match is high enough to be of concern is a question that should be considered carefully in each case by those who evaluate DNA evidence. The practical value of this article is in showing circumstances under which even low false positive probabilities should be of concern.

Conclusion

The present article does not address the difficult question of how to estimate the false positive probability, but it shows the importance of knowing how high that probability might be. Whether a suspect should be judged guilty or not guilty depends, in some cases, on whether the false positive probability is closer to 1 in 100, 1 in 1000, or 1 in 10,000. Particularly in cases in which there is little other evidence against the suspect, ignorance of the true probability of error creates a disturbing element of uncertainty about the value of DNA evidence. Commentators have noted the difficulty of generating accurate estimates of the probability of a false positive in a particular case (14,16,28). However, the task is no less important for being difficult.

External blind proficiency testing is said to be the best source of information about laboratory error rates (1,13,42). Of course, the rate of error in a proficiency testing does not necessarily equate to the false positive probability in a particular case because the unique circumstances of each case may make various types of errors more or less likely than average. Nevertheless, data on the rate of various types of errors in proficiency testing provide insight into the likely range of values for a particular case (14,42). When considering the probability of a false positive due to a sample switch error, it would clearly be helpful to know, for example, whether the rate of such errors in forensic laboratories in general is 1 in 50 or 1 in 20,000. Similarly, when considering the probability of a false positive due to inadvertent cross-contamination of samples, or misinterpretation of test results, it would be helpful to know how often cross-contamination, or misinterpretation, occurred in proficiency tests.

There has been continuing debate over the feasibility of external blind proficiency testing of forensic DNA laboratories. The National Institute of Justice funded a major study of this issue in which small-scale blind proficiency tests were conducted to assess their practicality and costs (43). The study found that blind proficiency testing is possible, although costly and “fraught with problems.” The estimated annual cost of administering two blind proficiency tests (involving simulated cases) to each of the 150 DNA testing laboratories in the United States was \$450,000 to \$3,020,000. The directors of the study recommended to NIJ that a program of blind proficiency testing be deferred in order to allow assessment of less

costly alternative programs, such as external laboratory audits, that might achieve many of the same goals. It remains to be seen whether an audit program will be implemented and whether such a program will produce useful data on laboratory error rates.

In the absence of such data, the problem of error will not go away. It will only become more acute as DNA testing is used in a widening range of cases. If DNA evidence is to achieve its full promise and potential, forensic scientists and legal professionals must give more attention to this issue.

Appendix

Here we describe how the traditional Bayesian likelihood ratio may be expanded to show the separate effect of the random match probability (RMP) and the false positive probability (FPP) on the value of a reported DNA match. Our analysis follows a method first described by David Schum and his colleagues for distinguishing reliability and diagnosticity of evidence in “cascaded inference” (33,44).

We begin by distinguishing R , a reported match, from M , a true match. We assume there are two possible underlying states of reality:

M : The suspect and the specimen have matching DNA profiles;

\bar{M} : the suspect and the specimen do not have matching DNA profiles.

However, it is impossible to know with certainty whether M or \bar{M} is true because the only information available about M , \bar{M} is the laboratory report, which might be mistaken.

The numerator of the conventional likelihood ratio, $P(R | S)$, is equivalent to the expression $P(R \cap S)/P(S)$, where $P(R \cap S)$ means the probability that *both* R and S occur. Furthermore, $P(R \cap S)$ can be written as the disjoint union of two compound events, $P(R \cap M \cap S)$ and $P(R \cap \bar{M} \cap S)$. Therefore, $P(R \cap S) = P(R \cap M \cap S) + P(R \cap \bar{M} \cap S)$.

Because

$$P(R \cap M \cap S) = P(R | M \cap S) \cdot P(M | S) \cdot P(S)$$

and

$$P(R \cap \bar{M} \cap S) = P(R | \bar{M} \cap S) \cdot P(\bar{M} | S) \cdot P(S),$$

we can eliminate $P(S)$ and write:

$$P(R | S) = P(R | M \cap S) \cdot P(M | S) + P(R | \bar{M} \cap S) \cdot P(\bar{M} | S)$$

The denominator of the likelihood ratio can be expanded in similar fashion. Hence, the likelihood ratio, in expanded form, can be written as:

$$\frac{P(R | S)}{P(R | \bar{S})} = \frac{P(R | M \cap S) \cdot P(M | S) + P(R | \bar{M} \cap S) \cdot P(\bar{M} | S)}{P(R | M \cap \bar{S}) \cdot P(M | \bar{S}) + P(R | \bar{M} \cap \bar{S}) \cdot P(\bar{M} | \bar{S})} \quad (5)$$

In order to simplify this rather cumbersome statement of the likelihood ratio, we will assume that $P(R \cap M)$ is independent of S , \bar{S} . In other words, we assume the probability that a match will be reported if there really is a match is not affected by whether the match is coincidental. Consequently, $P(R | M \cap S) = P(R | M \cap \bar{S}) = P(R | M)$. Because the suspect and specimen will necessarily have matching DNA profiles if the suspect is the source of the specimen, $P(M | S) = 1.00$ and $P(\bar{M} | S) = 0.00$. Finally, because \bar{M} can

only arise under \bar{S} , $P(R | \bar{M} \cap \bar{S})$ can be simplified to $P(R | \bar{M})$. Accordingly, Eq 5 can be re-stated as:

$$\frac{P(R | S)}{P(R | \bar{S})} = \frac{P(R | M)}{P(R | M) \cdot P(M | \bar{S}) + P(R | \bar{M}) \cdot P(\bar{M} | \bar{S})} \quad (6)$$

In this expanded version of the likelihood ratio, the term $P(R | M)$ is the probability that the laboratory will report a match if the suspect and the specimen have matching DNA profiles. If the samples are adequate in quantity and quality, and the laboratory is competent, we would expect $P(R | M)$ to be close to 1.00. Estimates of less than 1 imply that the laboratory may fail to detect a true match due, for example, to error (a "false negative") or inadequately sensitive procedures. For present purposes, we will simply assume that $P(R | M) = 1.00$.

The term $P(M | \bar{S})$ is the probability of a coincidental match. For a comparison between single-source samples, $P(M | \bar{S})$ is the random match probability, *RMP*, or the frequency of the matching profile in a relevant reference population. Because M and \bar{M} are mutually exclusive and exhaustive, $P(\bar{M} | \bar{S})$ is the complement of the *RMP*. Finally, the term $P(R | \bar{M})$ is the false positive probability, *FPP*. Substituting terms, the expanded likelihood ratio can be restated as in the form presented in the text as Eq 2:

$$\frac{P(R | S)}{P(R | \bar{S})} = \frac{1}{RMP + [FPP \cdot (1 - RMP)]} \quad (2)$$

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Commentary on: Thompson WC, Taroni F, Aitken CGG. How the probability of a false positive affects the value of DNA evidence. *J Forensic Sci* 2003;48(1):47–54.

Sir:

Thompson et al. (1) makes an interesting contribution to the literature of errors and DNA identification. Their essential and novel point is that even a small possibility of error may become important in those situations—namely a databank search or a dragnet—for which the prior odds for guilt of the matching suspect are very small. In effect, they note that the small prior odds have a (inverse) multiplier effect on the false positive probability. A false positive error rate that would be tolerable for suspect casework might therefore be intolerable, they argue, for “suspectless” cases (i.e., cases with no particularly suspicious suspect, where really there are thousands of suspects). Indeed, if the numbers that they use as examples are realistic, their argument would seem to spell doom for catching criminals through DNA databanks or dragnets.

Some may see a threat. We see opportunity. The reasoning advanced in (1) can be turned around and thereby give a possibly useful upper bound on the actual rate of false positives by taking advantage of the aforementioned multiplier effect. In brief, according to the example scenarios, dragnet and databank searches must quite often nab the wrong person. If to the contrary databank searches do not often nab innocent suspects, this contradiction would prove that the examples are unrealistic and that false positive errors occur at less than the speculated rate. For example, consider a dragnet with about 1000 suspects, so the prior odds for each is about 1:1000, random match odds 10^{-9} (which might as well be zero) and false positive probability $F = 10^{-4}$ —one of the hypothetical situations of Table 1 in (1). The posterior odds are then merely 10:1, which means that in $\frac{1}{11}$ of such cases the wrong suspect has been identified. The arithmetic for a databank hit is even more alarming, as the universe of plausible suspects may be larger. If for example the 100,000 profiles in the California DOJ databank are deemed to be suspects, again taking the approximation that the random matching odds are zero, and supposing $F = 10^{-4}$, the posterior odds that a cold hit catches the real culprit would be a miniscule 1:10—10 of every 11 hits are spurious! Can this be true?

There are ways to assess whether so dire a prediction is realistic. If even $\frac{1}{11}$ of identified suspects are random misidentifications, then follow-up investigation should crumble in many of these cases. In California and many jurisdictions, a case may not be prosecuted based on a databank hit alone. Therefore the mere fact of conviction provides some argument that follow-up investigations are available. Unfortunately, though, there are no records or statistics about what happens to databank hit cases. Investigators normally regard a databank hit as a tip, not a command, and do not routinely and systematically provide feedback as to the success of hits. A skeptic could plausibly believe that investigators hit a blind alley $\frac{1}{11}$ of the time and quietly drop the cases. A study could be done, but we admit it would not be easy.

One kind of blind alley, though, is special. If the suspect was incarcerated at the time of the offense—a powerful alibi—we expect that fact to come to light. Obviously, a substantial percentage of the people in a convicted offender databank, which is where cold hits come from, are repeat offenders and will be in jail at any given

time. If false positive errors occur, they should randomly identify innocent suspects independently of whether the innocent suspect is in jail. Therefore, assuming the example numbers suggested in (1), a predictable and significant proportion of databank hits should be disproved by prison records. We know of one such complaint (Dave Coffman, personal communication). The Florida Department of Law Enforcement has recorded about 980 cold hits. On one of them, a rape case, the investigator complained to the lab the suspect was in jail at the time of the offense. The reported match was not wrong—the suspect had an identical twin. This anecdote supports the thesis that prison alibis, if they existed, would be made known to the DNA laboratory. Common sense also supports it: an investigator who obtains the definite contradictory evidence of a prison alibi has something worth reporting back, as opposed to his vague situation when he merely fails to find confirmation. In any case, prison records can be systematically searched, either as a retrospective study to assess past databank hits, or it could be implemented as an automatic control to be checked for every hit in the future. Indeed, in California such an automatic control has been in place since the beginning of the databank. Of over 300 cold hits, none have been to inmates incarcerated at the time of the offense.

The false positive rates that are speculated in (1) are essentially citation of previous speculation; by comparison even off-the-cuff estimates based on our “prison alibi” reasoning might rate as sound. To that end, we estimate that $\frac{2}{3}$ of those in convicted offender databanks are repeat offenders, so a plausible guess is that 30% of the total are in prison at any given time. Therefore of erroneous cold hits, 30% should be contradicted by a prison alibi. California has had $C = 300$ cold hits to date, of which CF/P , F = false positive rate and P = prior odds, would be expected to be erroneous and $0.3CF/P$ contradictable by prison alibi. The observed value of $0.3CF/P$ is zero. Considering a 95% upper confidence estimate, probably therefore $0.3CF/P < 3$, or $F < 10P/C$. Taking $P = 10^{-3}$ as in (1), $F < 1/30000$. P may also be 10 or 100 times smaller, and worldwide C may be 10 or more times larger, suggesting $F < 1/10,000,000$. Of course these are crude estimates, and restricted by the limitations of statistics are merely upper bounds. Augmenting statistics by common sense some will argue that since convicted offender samples are catalogued by a contracting laboratory normally unrelated to the lab where the crime stain is analyzed, contamination or sample mix-up is unimaginable. In a dragnet situation, the crime stain is typed before the suspects are typed, and again $F > 0$ seems unimaginable. Imaginations vary though, so even our crudely estimated numerical upper bounds as to the rate at which the “impossible” happens might aid communication and insight.

The “confidence estimate” approach we used above is one that has sometimes been used (e.g., by the defense) to make the point that even a spotless record over 100 or 1000 cases provides—using a merely statistical analysis—less than certainty “beyond a reasonable doubt” against the possibility of error in the instant case. The “multiplier effect” we have referred to comes about because each of the many suspects in a dragnet or a databank is a separate opportunity for error, so the spotless record (if such it be) is effectively over five or so orders of magnitude more trials.

Naturally, the analysis we have presented is specific to the suspectless scenario. Suspect cases are often quite different and our comments might have no bearing. To the extent, though, that the

circumstances of evidence collection and analysis in a suspect case may be similar to the suspectless circumstances our estimates may be helpful.

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Author's Response

Sir:

While we appreciate the effort of Dr. Brenner and Mr. Inman to advance discussion of this important issue, we feel compelled to point out some limitations of their analysis and conclusions. The key problem is their unrealistic assumption that false positive errors are distributed randomly and uniformly across potential suspects. This assumption is crucial to their analysis although it is not required by the analysis offered in our article (1).

Our article focused on the probability that an innocent suspect could be incriminated under the facts of a particular case (which we called the "false positive probability"). Brenner and Inman focus on a somewhat different question—the proportion of innocent suspects who are falsely incriminated, which they call the "false positive rate." If there is a uniform, random distribution of false positive errors across potential suspects, as Brenner and Inman assume, then the false positive probability will equal the false positive rate. We believe, however, that the false positive probability may be far higher in some cases than others. As we explained in (1), the false positive probability is affected by a variety of case-specific factors and hence is a question that must be considered carefully in each case. Accordingly, a low overall rate of false positives does not preclude the possibility that some subset of all suspects face a substantial risk of false incrimination.

We agree with Brenner and Inman that the particular circumstances of databank searches can rule out or greatly reduce the probability of many types of errors and therefore are likely to assure a low overall rate of false positives. To our knowledge, no one (other than Brenner and Inman) has suggested that the arguments we set forth in (1) "would spell the doom for catching criminals through DNA databanks or dragnets." Hence, we think Brenner and Inman are attacking a strawman when they say that our reasoning implies that a substantial percentage of cold hits should be false. While we believe that the false positive probability in particular cases could easily be in the range discussed in (1), e.g., 10^{-4} , we do not think (and did not argue) that the false positive probability for every person in the databank on every search could be that high.

Our article was not about the overall rate of error in DNA testing. It was about the way in which the potential for error in a given case affects the probative value of the DNA evidence in that case. Although we assume the overall rate of error in databank searches is low, we believe the false positive probability could be high enough in some cases to be a serious concern. Brenner and Inman suggest that the probability a false positive due to a sample mix-up or cross-contamination is non-existent in most cold-hit cases because "convicted offender samples are catalogued by a contracting laboratory normally unrelated to the lab where the crime scene is analyzed." (emphasis added) We agree, but we note that safeguards that exist in most cases do not rule out the existence of a subset of cases in which the probability of error is higher than normal. It would be a serious mistake to disregard the potential for error in those cases based on arguments about the low overall rate of error.

The false positive probability may also be higher than normal in cases in which the perpetrator's profile is inferred from a sample that is mixed, degraded or marginal in terms of the quantity of DNA available. Mixture studies have shown significant rates of error in inferring the correct profile of minor contributors (2,3). Typically, the laboratory will get most of the profile right, but be

wrong on one or two alleles. Allelic drop-out due to degradation or stochastic effects might also contribute to mistyping a few alleles in a profile. The probability of a false incrimination in such cases will not be randomly distributed across the databank. Because the erroneous profiles in these cases will be similar to those of the true perpetrator, close relatives of the perpetrator who happen to have profiles in the databank will be far more likely to match (falsely) than others in the databank. Whether the false positive probability in such cases is high enough to be of concern is an issue that deserves careful consideration. Again, it would be a mistake to dismiss this concern based on arguments about the low overall rate of error.

Brenner and Inman infer that the overall rate of false positives in suspectless databank searches must be extremely low because they are aware of no instances in which an individual identified by a "cold hit" was able to be proven innocent by records placing him in prison at the time of the offense (except one case where the suspect allegedly had an identical twin). As already discussed, this argument does not prove that the false positive probability is extremely low in all cases. Hence, it does not and cannot refute the claim of a particular suspect that a false positive is likely to have occurred in his case. We also believe Brenner and Inman have made a minor error in their formula for computing the expected number of errors under their assumption of uniform, random distribution of error. We believe the correct formula, using their nomenclature, is $CF/(F + P)$, rather than CF/P , and hence that the expected number of errors is not quite as high as they suggest.

Despite these differences in our perspectives, we agree with Brenner and Inman that the overall rate of false positives is an important issue. We also agree that the number of "cold hits" that are disconfirmed by other evidence is likely to be highly probative of the overall rate of false positives. We commend Brenner and Inman for raising this important point.

We believe, however, that it is unsatisfactory and potentially misleading to address this issue on the basis of anecdotal evidence. The issue is sufficiently important to warrant a systematic and public program of research on the results of databank searches. To assess the overall false positive rate in a rigorous manner it will be necessary to know how many searches are conducted, how discriminating the searches are, and how many produce "cold hits" as well as the number of "cold hits" that are "confirmed" and "disconfirmed" by subsequent evidence. In light of the argument advanced by Brenner and Inman, it is now clear that this information is highly relevant to an issue of significant public importance—the overall rate of error in suspectless databank searches. Indeed, we believe criminal suspects who are incriminated by "cold hits" will be able to use the Brenner and Inman argument to make a strong case that they should be entitled to review the type of data described here due to its relevance to the overall reliability of the system that incriminated them. Accordingly, we urge that systematic collection and reporting of the relevant data begin immediately, and we thank Brenner and Inman for illustrating the importance of doing so.

Finally, we think Brenner and Inman are mistaken when they imply that the concerns raised in our article (1) apply only to dragnet and databank search cases. The primary message of our article is that even a seemingly low false positive probability, on the order of 10^{-3} , 10^{-4} , or even lower, can substantially undermine the value of DNA evidence, and create a significant risk of false incrimination, *when the other evidence against the suspect is weak*. The *other evidence* is often weak in cold hit cases, but it can also be weak in conventional cases when, for example, the suspect produces a

strong alibi. One of the cases in which a DNA false positive caused a false conviction, for example, was that of Timothy Durham, who produced eleven alibi witnesses to testify that he was in another state at the time of the crime. Any reasonable assessment of the evidence in the case, ignoring the DNA, should have indicated a low (prior) probability that Durham was guilty. In such cases, the false positive probability looms large in determining the probative value of the DNA evidence and therefore the possibility of an error should always be an important consideration.

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Model Discovery Request for STR Test Results

DISCOVERY REQUEST

INTRODUCTION:

This is a request for disclosure of scientific materials pertaining to DNA testing performed in the case of [case name] ([County, Case Number]). This request applies to all DNA testing that has been, is currently being, or will be performed in the instant case. The request is ongoing. In the event that new materials responsive to this request are produced, discovered, or otherwise come into the possession of the prosecution or its agents, said materials should be provided to the defendant without delay.

In the event that there is a charge for reproducing any of these materials please include an itemized list indicating the number of items (for example number of pages of documents, number of photographs, X-ray films, number of CD-ROMs, etc.) and the cost of copying per item.

- 1. Case file: Please provide a complete copy of the case file including all records made by the laboratory in connection with this case. If the file includes photographs, please include photographic quality copies.**
- 2. Laboratory Protocols: Please provide a copy of all standard operating protocols (SOPs) used in connection with the testing in this case. To minimize any burden of duplicating these items, we invite you to provide them in electronic form.**
- 3. Chain of custody and current disposition of evidence: Please provide copies of all records that document the treatment and handling of biological evidence in this case, from the initial point of collection up to the current disposition. This information should include documentation which indicates where and how the materials were stored (temperature and type of container), the amount of evidence material which was consumed in testing, the amount of material which remains, and where and how the remaining evidence is stored (temperature and type of container).**
- 4. Software: Please provide a list of all commercial software programs used in the DNA testing in this case, including name of software program, manufacturer and version used in this case.**
- 5. Macros: If the results produced by the software are dependent on the instructions contained in macros, please provide copies of any macros used. (For analyses performed with GeneScan and Genotyper, these macros are contained in Genotyper output files in order to allow analysts to interpret the results. Simply providing a copy of the Genotyper output files in response to request 6 will satisfy this request as well).**

6. **Data files: Please provide copies of all data files used and created in the course of performing the testing and analyzing the data in this case. These files should include all data necessary to, (i) independently reanalyze the raw data and (ii) reconstruct the analysis performed in this case. For analyses performed with GeneScan and Genotyper, these materials should include**
 - (6.1) All collection files (such as injection lists and log files for an ABI 310 analysis).
 - (6.2) All Genescan files, including sample files and project files.
 - (6.3) All Genotyper files, including templates/macros (see Request 5).
7. **STR frequency tables: Please provide copies of any allelic frequency tables relied upon in making statistical estimates in this case. If the laboratory relied upon published or publicly available data, this request can be satisfied by providing a specific reference to the source.**
8. **Documentation of Corrective Actions for Discrepancies and Errors: According to the DNA Advisory Board Quality Assurance Standards for Forensic DNA Testing Laboratories, Standard 14, forensic DNA laboratories must “follow procedures for corrective action whenever proficiency testing discrepancies and/or casework errors are detected” and “shall maintain documentation for the corrective action.” Please provide a copy of all documentation of corrective actions maintained by the laboratory that performed DNA testing in this case. If the laboratory does not comply with the DAB requirement that it maintain this documentation, it is sufficient to respond: “The laboratory does not comply with the DAB requirement that it document corrective actions.”**
9. **Accreditation: Please provide copies of all licenses or other certificates of accreditation held by the DNA testing laboratory.**
10. **Laboratory personnel: Please provide background information about each person involved in conducting or reviewing the DNA testing performed in this case, including:**
 - (10.1) Current resume
 - (10.2) Job description
 - (10.3) A summary of proficiency test results

Chapter 11

DNA in the Courtroom

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DNA IN THE COURTROOM

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I. INTRODUCTION¹**§ 11:1 Overview**

English geneticist Alec Jeffreys first described a method for "typing" human DNA in 1985. Since that time, DNA typing technology has advanced rapidly and the new DNA tests have been embraced eagerly by the criminal justice system. DNA tests are now routinely used to help identify the source of blood, semen, hair and other biological materials found at crime scenes and to establish family relationships in cases of disputed parentage. DNA tests have helped prosecutors obtain convictions in thousands of cases and have helped establish the innocence of thousands of individuals who might otherwise have become suspects.

Though it has been invaluable to the justice system, DNA evidence has the potential to be tremendously misleading in some cases. DNA tests can be botched, misinterpreted,

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Dan E. Krane is an Associate Professor in the Department of Biological Sciences at Wright State University where he has been a faculty member since 1993. His research interests are primarily in the areas of molecular evolution and the way that gene frequencies change over the course of time in populations of organisms. He has published widely on the subject of forensic DNA testing and has testified in over 40 criminal cases since 1991 as an expert for both the prosecution and defense in the areas of population genetics, molecular biology and bioinformatics. He is also the president and founder of Forensic Bioinformatic Services, Inc (bioforensics.com) where he has overseen the development and implementation of software designed to automatically and objectively review STR DNA testing results.

mischaracterized and misunderstood. Cases have come to light in which innocent people were convicted based on bad DNA evidence. Controversy continues over how to assure the reliability of DNA tests and how to describe the statistical significance of test results. The issues lawyers face when dealing with DNA evidence can be extraordinarily complex and confusing.

This chapter is designed to help lawyers make sense of DNA evidence. It aims to be comprehensible even to the science-phobic while providing enough detail to allow understanding of the real issues.

Section I (Introduction) begins with a broad overview of the different DNA tests that lawyers may encounter, describing in general terms the strengths and weaknesses of each test. This overview will be particularly helpful for those who are encountering DNA evidence for the first time and for those who find themselves losing track of the "big picture" while wading through technical details (a common experience among lawyers who litigate DNA cases). Section II (A Closer Look at the Science of DNA Testing) provides a more detailed and technical account of the various DNA typing methods and includes discussion of steps lawyers should take to evaluate evidence generated by each method. It offers extensive coverage of the automated STR tests that are currently the most widely used. Section III (How the Courts Have Approached DNA Testing) provides a review of key appellate decisions from around the country on the admissibility and presentation of DNA evidence. It discusses the history and evolution of DNA litigation, including the most recent decisions. [Note: Because the science and the case law on DNA testing changes rapidly, it is essential for any practitioner dealing with this issue to update every case before relying upon it.] Section IV (Some Critical Thoughts on DNA Evidence) addresses some remaining concerns about DNA evidence, and Section V provides guides and checklists for prosecutors and defense lawyers on dealing with DNA evidence.

When discussing DNA evidence it is difficult to find an appropriate middle ground between a highly technical explanation that overwhelms readers with details and a more readily understandable explanation that leaves out crucial points. Readers should be aware that the materials in this chapter are introductory and by no means comprehensive. Lawyers

handling a DNA case would be well advised to consult the original source materials referenced in this section for more complete information on points relevant to their case. Seeking the assistance of a more experienced lawyer to evaluate your case is also helpful. Ultimately, there is no acceptable substitute for having an independent scientific expert review the underlying laboratory work to check for problems and to help you understand the strengths and possible limitations of the evidence. Prosecutors and defense lawyers are both well advised to have test results reviewed by an expert other than the one who produced them. Independent experts and consulting services (such as www.bioforensics.com)² can help organize and distill the complicated results of DNA testing procedures in a way that facilitates discussing the most important issues and alternative interpretations for your case.

§ 11:2 An introduction to DNA and DNA testing

The following sections provide an overview of DNA testing methods and introduces basic terminology. They are designed to orient DNA novices to the basic issues. More detailed treatments of the various methods are found in subsequent sections.¹

§ 11:3 An introduction to DNA and DNA testing—The Nature of DNA

Deoxyribonucleic acid, or DNA, is a long, double-stranded molecule configured like a twisted ladder or "double helix." The genetic information of all organisms is encoded in the sequence of four organic compounds (bases) that make up the rungs of the DNA ladder. Most DNA is tightly packed into structures called chromosomes in the nuclei of cells. In

[Section 11:1]

²Both Professors Thompson and Krane have a financial interest in Bioforensics.

[Section 11:2]

¹For more detailed discussions, see National Research Counsel Report I ("NRCI"); National Research Counsel Report II ("NRCII"); John M. Butler, *Forensic DNA Typing* (Academic Press, 2001). Much of sections 11:2 through 11:10 is also found in W.C. Thompson, *DNA Testing*, *Encyclopedia of Crime and Punishment* (David Levinson, ed., (Sage, 2002)).

humans there are 23 pairs of chromosomes; half of each pair is inherited from the individual's mother, half from the father. The total complement of DNA is called the *genome*.

By some estimates, 99.9 percent of the genetic code is the same in all humans. To identify individuals, DNA tests focus on a few *loci* (plural of *locus*-a specific location on the human genome) where there is variation among individuals. These *loci* are called *polymorphisms* because the genetic code can take different forms in different individuals. Each possible form is called an *allele*.

Forensic DNA tests have examined two types of polymorphisms. *Sequence polymorphisms* vary only in the sequence of the genetic code. *Length polymorphisms* contain repeating sequences of genetic code; the number of repetitions may vary from person to person, making the section longer in some people and shorter in others.

Analysts begin the testing process by extracting DNA from cells and purifying it. They use test tubes, chemical reagents, and other standard procedures of laboratory chemistry.

In sexual assault cases, spermatozoa (containing male DNA) may be mixed with epithelial (skin) cells from the victim. Analyst generally try to separate the male and female components into separate *extracts* (samples) using a process called *differential lysis*, which employs weak detergents to liberate DNA from the epithelial cells followed by stronger detergents to liberate DNA from the tougher spermatozoa.

After the DNA is extracted, it can be "typed" using several different methods.

**§ 11:4 An introduction to DNA and DNA testing—
Overview of RFLP Analysis**

When DNA tests were first introduced in the late 1980's, most laboratories employed a method called *RFLP analysis* (*restriction fragment length polymorphism analysis*), which uses enzymes to break the long strands of DNA into shorter fragments (*restriction fragments*) and separates these by length (using a process called *electrophoresis*). A pattern of dark bands on an x-ray or photographic plate reveals the position (and hence the length) of target fragments that contain *length polymorphisms*.

Figure 1: RFLP Autorad in a Rape Case

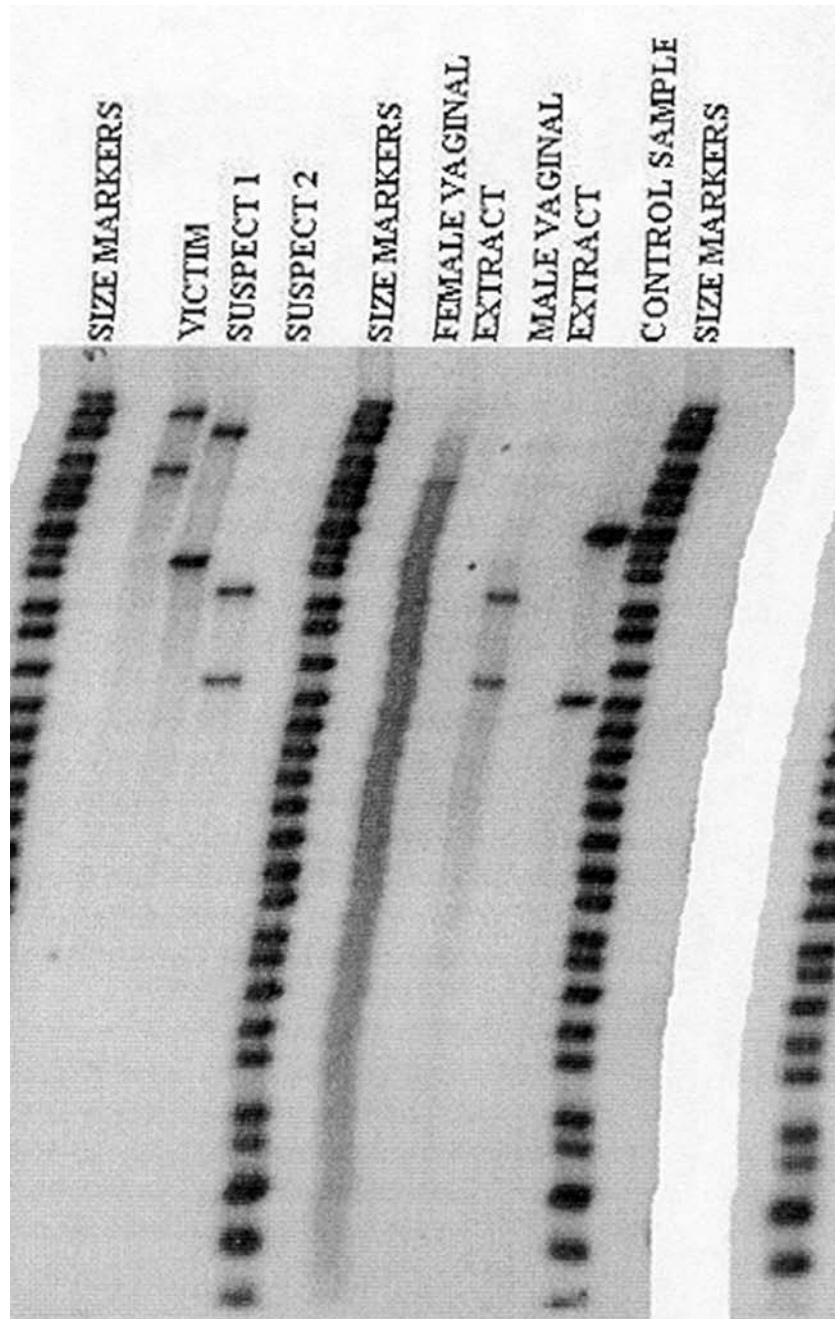


Figure 1 shows RFLP analysis of a single *locus* (containing a *length polymorphism*) in a case in which a woman was raped by two men. Each "lane" contains DNA from a different sample. The lanes labeled "size markers" contain DNA fragment of known size from bacteria and are used for calibration. Lanes on the left side show the band patterns produced by reference samples from the victim and two suspects. There are two bands in each lane because each individual has two copies of the relevant locus, one from the paternal half of the chromosome, the other from the maternal half.

Lanes on the right side of Figure 1 show the band patterns of evidence samples. The lane labeled "female vaginal extract" contains DNA from the female component (epithelial cells) of a vaginal sample taken from the victim. The DNA in this sample was too degraded to produce a distinct band pattern. The lane labeled "male vaginal extract" shows the band pattern of DNA from the male component (spermatozoa) of the same vaginal sample. This lane contains a band pattern similar to that of suspect 2, which indicates that the spermatozoa could have come from suspect 2.

In a typical case, four to six different loci (each containing a different length polymorphism) are examined in this manner. The full set of alleles identified in a sample is called its *DNA profile*. Because the probability of a "matching" pattern at any locus is on the order of one in hundreds to one in thousands, and the probabilities of a match at the various loci are assumed to be statistically independent, the probability of a match at four or more loci is generally put at one in many millions or even billions.

Although RFLP analysis is generally reliable, it sometimes entails subjective judgment. Whether the lane labeled "male vaginal extract" also contains bands corresponding to those of suspect 1 is a matter of judgment on which experts in this case disagreed. Dots to the left of the lane are felt-tip pen marks placed by a forensic analysis to indicate where he thought he saw bands matching those of suspect 1.¹

RFLP analysis requires samples that are relatively large

[Section 11:4]

¹Suspect 1 was charged with rape, but rape charges were later dropped when the defense was able to show that the laboratory could not reliably detect bands matching Suspect 1 using objective methods. For a useful

(blood or semen stains about the size of a quarter) and well-preserved. It is also slow. A typical case takes four to six weeks.

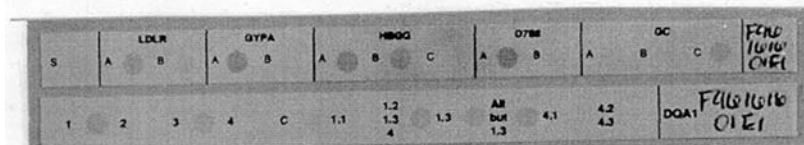
discussion of the scientific and legal issues in this case, see W. Thompson, Challenging the Forensic DNA Evidence in *People v. Marshall*, <http://www.scientific.org/case-in-point/cases.html>. (includes copies of motions filed in the case).

§ 11:5 An introduction to DNA and DNA testing— DQ-Alpha and Polymarker Tests

In the early 1990s, newer methods of DNA testing were introduced that are faster (producing results in a day or two) and more sensitive (i.e., capable of typing smaller, more degraded samples). The new methods use a procedure called *polymerase chain reaction (PCR)*, which can produce billions of copies of target fragments of DNA from one or more loci. These "amplified" DNA fragments (called *amplicons*) can then be typed using several methods.

In 1991, Perkin-Elmer (PE), a biotechnology firm, developed a test kit for amplifying and typing a *sequence polymorphism* known as the DQ-alpha gene. Six distinct *alleles* (variants) of this gene can be identified by exposing the amplified DNA to paper test strips containing *allele-specific probes* (see Figure 2). The dots on the strip signal the presence of particular alleles. This test has the advantage of great sensitivity (DNA from just a few human cells is sufficient to produce a result) and allows more rapid analysis (1-2 days), but it is not as discriminating as RFLP analysis.

Figure 2: Test Strip Showing Polymarker (top) and DQ-Alpha (bottom) Test Results



In 1993, PE introduced an improved kit that typed DQ-alpha and five additional genes simultaneously, thereby improving the specificity of this method (See Figure 2). With this new kit, known as the Polymarker/DQ-alpha test, individual profile frequencies are on the order of one in tens of thousands, however it still is not as discriminating as RFLP analysis. As with RFLP analysis, interpretation of the test strips may require subjective judgments. For example, experts disagreed on whether the dot labeled 1.3 in the lower strip shown in Figure 2 is dark enough to reliably indicate the presence of the allele designated 1.3.

§ 11:6 An introduction to DNA and DNA testing— STR Tests

The late 1990s saw the advent of *STR* (*short tandem repeat*) DNA testing. STR tests combine the sensitivity of a PCR-based test with great specificity (profile frequencies potentially as low as one in trillions) and therefore have quickly supplanted both RFLP analysis and the Polymarker/DQ-alpha test in forensic laboratories.

An *STR* is a DNA locus that contains a length polymorphism. At each STR locus, people have two alleles (one from each parent) that vary in length depending on the number of repetitions of a short core sequence of genetic code. A person with *genotype* 14, 15 at an *STR locus* has one allele with 14 repeating units, and another with 15 repeating units.

Figure 3: STR Test Results

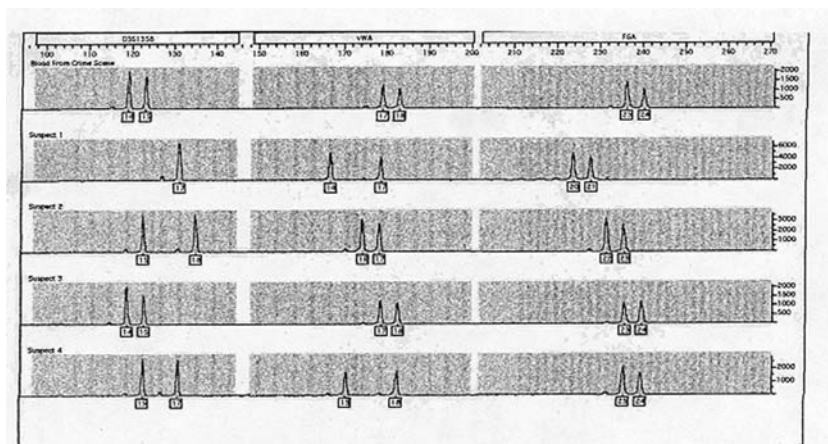


Figure 3 shows the results of STR analysis of five samples: blood from a crime scene and reference samples of four suspects. This analysis includes three loci, labeled "D3S1358," "vWA," and "FGA." Each person has two alleles (peaks) at each locus, one from the maternal portion and the other from the paternal portion of the chromosome. The position of the "peaks" on each graph (known as an electropherogram) indicates the length (and hence the number of core sequence repeats) of each STR. As can be seen, the profile of suspect 3 corresponds to that of the crime scene

sample, indicating he is a possible source. Suspects 1, 2 and 4 are eliminated as possible sources.

In 1997, the FBI identified 13 STR loci that it deemed appropriate for forensic testing. Commercial firms quickly developed test kits and automated equipment for typing these STRs. The most popular test procedure, developed by Applied Biosciences International (ABI), a PE subsidiary, includes a PCR kit known as *ProfilerPlus* that simultaneously "amplifies" DNA from up to nine STR loci and labels the loci with colored dyes. An automated test instrument called the ABI 310 Genetic Analyzer then separates the resulting amplicons by length (using electrophoresis) and uses a laser to cause fluorescence of the dye-labeled fragments. A computer-controlled electronic camera detects the size and relative position of the fragments, identifies alleles, and displays the results as shown in Figure 3.

STR tests have greatly improved the capabilities of forensic laboratories, allowing highly specific DNA profiles to be derived from tiny quantities of cellular material. Test results often allow a clear-cut determination of whether a particular individual could be the source of an evidentiary sample, although experts have differed over interpretation of results in some cases, particularly those involving mixed samples (DNA from more than one person) and low quantities of DNA.

§ 11:7 An introduction to DNA and DNA testing— Y-STR Tests

Several laboratories have recently developed tests to examine polymorphic areas of the Y-chromosome, which is possessed only by males. These tests may be useful in sexual assault cases where the DNA of a male contributor is mixed with DNA of a female victim. If there is too much DNA from the victim, relative to the male contributor, the male component is difficult to type using standard STR's. Because the Y-STR tests focus on DNA of males only, the male component is easier to detect and type with these tests.

The method for typing Y-STR markers is similar to that used for standard STR tests. Genetic probes identify and label relevant sections of the Y-chromosome, which are amplified using PCR and then run through an automated instrument such as the ABI 310 Genetic Analyzer, which

separates the fragments by length through electrophoresis and uses laser light and a computer-controlled camera system to detect the florescent dye-labeled fragments. The results are displayed on electropherograms that are similar in appearance to Figure 3, except that each person has a single peak at each locus (because the Y-markers are inherited only from the father).

The major disadvantage of Y-STR tests is that they are far less discriminating than standard STR tests. Moreover, they have not been as carefully validated or as widely used as standard STR tests, so they may be more vulnerable to admissibility challenges. Finally, because the Y-STR markers are inherited paternally, they will generally be the same for all men in the same paternal line. Hence, these tests cannot distinguish father from son, sons of the same father, or even paternal cousins.

§ 11:8 An introduction to DNA and DNA testing— Mitochondrial DNA Tests

The tests described thus far examine DNA from cell nuclei (*nuclear DNA*). DNA is also found in *cell mitochondria*, which are *organelles* (structures) in which the process of cellular respiration occurs. Mitochondrial DNA (often designated *mtDNA*) contains *sequence polymorphisms*. In the late 1990s, forensic scientists began testing mtDNA by using a procedure known as *genetic sequencing* to produce a read-out of the genetic code from two polymorphic areas of the *mitochondrial genome*. Forensic scientists describe an mtDNA profile by stating how its sequence differs from that of a reference standard called the *Anderson sequence*.

Mitochondrial DNA tests are highly sensitive and can produce results on samples that are not suitable for other DNA tests, such as hair shafts, bone, and teeth. Because mtDNA is present in hundreds or thousands of copies per cell, it often survives much longer than nuclear DNA in old, degraded cellular samples. DNA tests on very old samples, such as the bones of Czar Nicholas II of Russia, have detected and typed mtDNA.

Mitochondrial DNA tests are far less discriminating than STR tests. The frequency of mtDNA profiles is generally put at one in hundreds. Additionally, because mtDNA is inherited maternally, mtDNA tests generally cannot distinguish

between individuals in the same maternal line. Hence, sons of the same mother would be expected to have the same mtDNA profile, and this profile would also be found in daughters of the mother's sister and all of their children.

Minor variations are sometimes found in mtDNA profiles of different cells from the same person due to mutations. This phenomenon, known as *heteroplasmy*, complicates the process of determining whether two mtDNA profiles match. The appropriate standards for declaring an mtDNA match, and for estimating the rarity of matching profiles, are issues that have been debated in the courtroom.

Mitochondrial DNA tests are expensive and require special laboratory facilities and techniques. At this time only a few forensic laboratories perform these tests and they are used only where other types of DNA testing fail or cannot work. However, future technical improvements may lead to wider use of mtDNA tests.

§ 11:9 Reliability and Quality Assurance

Although current DNA technology is capable of producing highly reliable results, questions are sometimes raised about the quality of laboratory work. Key issues include the potential for biased or mistaken interpretation of laboratory results and the possibility for error due to mishandling of samples. Acknowledging problems with the quality of early DNA testing procedures, a 1992 report of the National Research Council called for broader scrutiny of forensic DNA testing by a scientific body from outside the law enforcement community.

In response, the U.S. Federal Bureau of Investigation (FBI) created its own advisory body that was initially called the Technical Working Group for DNA Analysis Methods (TWGDAM) and more recently called the Scientific Working Group for DNA Analysis Methods (SWGDM). The FBI director appoints its members. Although it has not satisfied all critics of forensic laboratory practices, this body has been credited with issuing guidelines that have improved the quality of forensic DNA work. For example, SWGDM guidelines call for each analyst to take two proficiency tests each year.

Another quality assurance mechanism is laboratory accreditation. The American Society of Crime Laboratory

Directors Laboratory Accreditation Board (ASCLAD-LAB) is a non-profit organization that reviews the protocols and procedures of forensic DNA laboratories and issues a certificate of accreditation to those meeting its standards. To help assure the competence of laboratory workers, a professional organization called the American Board of Criminology, has developed a certification program for DNA analysts.

Despite these efforts, problems occasionally come to light. Errors have occurred in proficiency tests and occasional errors arising from accidental switching and mislabeling of samples or misinterpretation of results have come to light in court cases. There are two known cases in which misinterpretation of DNA tests contributed to the wrongful rape convictions of a men who later were exonerated by more comprehensive DNA testing.

A 1996 report of the National Research Council suggested that retesting of samples is the best way to address remaining concerns about the quality of laboratory work. The great sensitivity of PCR-based DNA tests makes it possible to split samples for duplicate analysis in most cases.

§ 11:10 Dragnets, Databanks and Cold Hits

The United Kingdom and all fifty American states now have government-operated *databanks* containing the DNA profiles of known offenders. Many crimes have been solved when a databank search revealed a match between the DNA profile of a blood or semen sample left by the perpetrator at a crime scene and the profile of a known individual in the databank. A databank match is called a *cold hit*.

The FBI maintains a national databank of DNA profiles known as *CODIS (Combined DNA Indexing System)*, which includes a Convicted Offender Index (containing profiles of offenders submitted by states) and a Forensic Index (containing DNA profiles of evidence related to unsolved crimes). CODIS allows government crime laboratories at a state and local level to conduct national searches which might reveal, for example, that semen deposited during an unsolved rape in Florida could have come from a known offender from Virginia.

Government databanks were initially limited to convicted violent or sex offenders. However, there has been serious discussion of expanding databanks to include arrestees, or

even to make them universal (perhaps by sampling DNA from all citizens at birth), in the interest of better crime control.

Civil libertarians have expressed concern that government agencies could use the genetic information they collect in an intrusive or inappropriate manner. The information included in CODIS is limited to numerical data that designate RFLP and STR profiles. These profiles are useful for identifying individuals but are linked to no known medical or behavioral characteristics. However, most states have retained blood samples from those included in state databanks. State and federal statutes limit the disclosure of information contained in government databanks and generally specify that it be used solely for law enforcement purposes.

When police have the DNA profile of a perpetrator but cannot establish his or her identity, they sometimes conduct what has become known as a *DNA dragnet*, in which large numbers of individuals in the relevant community are asked to submit samples voluntarily for DNA testing. Police generally collect samples by rubbing inside the individual's cheek with a cotton swab. Even if the guilty party does not submit a sample, the DNA dragnet may help police by narrowing the number of possible suspects. The first DNA dragnet, which was chronicled in Joseph Wambaugh's book "The Blooding," helped police solve two murders in Leicester, England, in 1987. The guilty man was identified when, in an effort to avoid suspicion, he asked a friend to submit a sample in his place. DNA dragnets have since been used repeatedly in Britain and are becoming more common in the U.S.

Prosecutors in some jurisdictions have developed a procedural innovation called a *DNA warrant* as a means of avoiding the statute of limitations in cases where they have DNA from the perpetrator but have not yet identified a suspect. Before the statute of limitations runs out, charges are formally filed in the case, but the "defendant" is identified by DNA profile rather than by name. The legality and constitutionality of this practice is still subject to debate.

§ 11:11 The rapidly evolving science of DNA testing

Continuing developments in molecular biology are sure to spawn further changes in DNA testing in the future. New

innovations often have a honeymoon period in which they are rapidly embraced by the courts, followed by a period of more critical scrutiny. When RFLP tests were first introduced in 1988, for example, they were virtually unchallenged. By 1991, however, serious questions were being raised about quality control and about the assumptions underlying statistical estimates. Lawyers should bear this history in mind when evaluating new DNA testing methods. It often takes time for problems to be identified and for scientific dissent to emerge.

At the time of this writing, STR testing is widely used. Although there is still some controversy about interpretation in some cases, particularly those involving mixtures and low quantities of DNA, the technology per se appears to be well established. Much of the current controversy, however, still centers around the flexibility associated with laboratory protocols and the possibility of errors and contamination occurring in the laboratory. Emerging issues appear to be questions regarding the appropriate statistics to apply in increasingly common cases where suspects are initially identified by DNA testing results ("cold hits" or "database trawls") and concerns over the lack of independence of most DNA testing labs from law enforcement agencies. Y-STRs and mtDNA are less widely used and may still be vulnerable to admissibility challenges as well as to attacks on the quality of results in specific cases.

Although this book will be updated on a regular fashion, there is no replacement for scanning through Westlaw and the Internet to find the most recent developments in the law. For example, in any three-month period, there may be dramatic changes in the DNA landscape of research that you will need to be aware of if you have a case with these issues.

In the event you work with the government, you can obtain access to the FBI's most recent data as well as their experts.¹ If you are a defense lawyer, you might want to contact the lawyers involved with the NACDL² DNA Task Force who

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¹A more recent FBI publication is IA US Dep't of Justice FBI Report, VNTR Population Data; A Worldwide Study (1993).

²National Association of Crime Defense Lawyers (NACDL).

specialize in DNA litigation³ or utilize web based resources like www.bioforensics.com.

II. A CLOSER LOOK AT THE SCIENCE OF DNA TESTING

§ 11:12 What is DNA?

To biologists, DNA is *the* genetic material. That is a powerful statement in that it means that DNA is the molecule that is responsible for passing information from one generation to the next. As a result, DNA is often called the blueprint of life. A genome is the sum total of an organism's genetic material and is essentially contained entirely within the DNA molecules that make up its chromosomes. Information is stored in DNA in the sequence in which one of four different chemical building blocks (called nucleotides) are arranged in much the same way that information is stored in a written document by the specific sequence of letters that are used to spell out words. Current estimates are that the 3.2 billion nucleotides of the human genome spell out approximately 30,000 genes. Each of those genes is responsible for making at least one different protein. Failure to make one of those proteins at the appropriate place, time or level generally results in: death; a disease state (like cancer, cystic fibrosis or muscular dystrophy); or the normal differences we see between people (such as those associated with intelligence or height and hair, eye and skin coloration). People are remarkably similar to other organisms at the level of the nucleotide sequence of their DNA (on average, we are 98 percent identical to chimpanzees) as well as to each other (even the most distantly related people are 99.5 percent identical). However, only identical twins are absolutely identical at the level of their DNA and the small percent difference translates into an enormous number of differences given the overall size of the human genome.

³The NACDL DNA Task Force has regional members. For further information, you can contact NACDL, 1110 Vermont Avenue, NW, Suite 1150, Washington 20005, tel. 202-872-8688; fax. 202-331-8269.

A perfect copy of an individual's DNA is found in all the nucleated cells of their body (of which there are trillions¹) and is stored in forty-six pairs of chromosomes; twenty-three chromosomes are inherited from the mother and a roughly equivalent set of twenty-three are inherited from the father.² At a finer scale, DNA (an abbreviation for "deoxyribonucleic acid") has the shape of a double-helix, as first described in 1953 by scientists James Watson and Francis Crick, who won the Nobel Prize for the discovery of the structure of DNA.

DNA's double helix has been described as resembling a spiral staircase. The nucleotide components of a DNA molecule can themselves be broken down in three parts: a phosphate group, a sugar (ribose), and a nitrogenous base (one of four known as guanine, adenine, thymine or cytosine and commonly referred to by just the first letter of their name).

The "handrails" of the staircase are composed of the phosphate group and its linkage to the sugar of each nucleotide. Between the two handrails are the "steps" of the DNA staircase where the nitrogenous bases specifically interact with each other through hydrogen bonds. Each of the four types of these nucleotides (G, A, T and C as described above): pairs up only as either A:T or G:C. In other words, guanine cannot pair with thymine, nor can cytosine pair up with adenine.³ These "nitrogenous base pairs" (or simply "basepairs" or "bp") effectively represent a simple alphabet that stores information useful to cells. The 0.5% difference in the nucleotide sequence between two people are not evenly distributed across the human genome. Locations (or loci, the plural of locus) where there is a great deal of difference in the base pair pattern of the genes are said to be "polymorphic" sites, meaning "many forms." Many polymorphic genes are known to be functionally important: some are responsible

[Section 11:12]

¹Because red blood cells of mammals are not nucleated, they contain no DNA.

²See David H. Kaye and George F. Sensabaugh, Jr., Reference Guide on DNA Evidence, at 485, 491 in Reference Manual on Scientific Evidence (2d Ed. West Group, 2000) (hereinafter referred to in this section as "Reference Guide on DNA Evidence.").

³See *People v. Soto*, 21 Cal. 4th 512, 88 Cal. Rptr. 2d 34, 981 P.2d 958, 963 (1999).

for the color of eyes or hair and the type of blood we each have. Most, however, polymorphic regions are free to differ substantially between people because they appear to have no function and are typically the ones used in DNA testing. These polymorphic sites are the ones that DNA testers use in determining whether DNA from an evidence sample is likely to be from the same person that contributed a reference sample for DNA testing. How this process is completed is explained below.

At some of the polymorphic sites, the differences are due to the number of times that short sequences of the base pairs repeat in tandem, over and over. These repeating units are called a Variable Number Tandem Repeat (VNTR) and each of the repeated sequences may contain a few or several dozen nucleotide bases.⁴ One currently very popular subset of VNTR loci have just four nucleotides in each repeated unit and are commonly referred to as Short Tandem Repeats (STRs).

§ 11:13 The RFLP method of creating DNA profiles¹

In the short while since its first use in U.S. courts beginning in 1988, four substantially different methods of DNA profiling have been used. The earliest methodology used in forensic application in the United States is the so-called Restriction Fragmentation Length Polymorphism Method, commonly known as the "RFLP" method. RFLP analyses are no longer performed by the vast majority of DNA typing laboratories. The newer, more commonly used methods of

⁴Reference Guide on DNA Evidence at 963.

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¹In 2000, the Federal Judicial Center published the Second Edition of the Reference Manual on Scientific Evidence (West Group, 2000). The chapter on DNA evidence provides an overview of DNA science and testing procedures, as well as a discussion of appropriate protocol and guidelines for collection, testing and interpretation of results. See David H. Kaye and George F. Sensabaugh, Jr., Reference Guide on DNA Evidence, at 485 in Reference Manual on Scientific Evidence (2d Ed. West Group, 2000). An electronic version of the Manual is online at <http://air.fjc.gov/public/fjcweb.nsf/pages/16>. One of the most comprehensive books about DNA technology to be published recently is John M. Butler, Forensic DNA Typing (Academic Press, 2001). This book contains an in-depth discussion and analysis of DNA, methods of DNA typing, and the established and developing technologies used in forensic DNA.

DNA profiling are discussed below but RFLPs are still described here because the DNA profiles generated in this way do still occasionally appear in court (particularly for older cases or those under appeal) and because the underlying methodology is a good starting point for understanding the latest approaches to DNA typing.

Forensic RFLP tests examine loci that contain highly variable numbers of tandem repeats, or VNTRs. A *tandem repeat* is an end-to-end duplication of a short sequence of the genetic code. If the DNA strand were a phonograph record, this would be an area where the record skipped and repeated a number of times before playing the rest of the tune. The number of repetitions tends to vary from person to person. Consequently, when the DNA strands are broken into fragments, and the fragments containing VNTRs are measured, their length tends to vary from person to person. (See Figure 1). This variation is known as a *length polymorphism*.

The DNA is broken into fragments by cutting it with one of several *restriction enzymes*. These enzymes act as "molecular scissors," cutting the DNA strand at specific, known sites, and producing shorter fragments known as *restriction fragments*. For example, the restriction enzyme HaeI cuts only at the sequence "AGGCCA" (which occurs randomly about once every 4,000 base-pairs). The restriction enzymes chosen for forensic RFLP tests cut in areas that flank the VNTRs. The goal of the test is to measure the length of these VNTR-containing restriction fragments, hence the overall procedure is called *restriction fragment length polymorphism analysis*.

In order to create a RFLP profile of DNA, a sample of blood the size of a quarter was needed or a sample of semen with several hundred thousand sperm must be collected. It is from these samples that scientists are able to determine a genetic or DNA profile, identifying a person through his² genetic code. Unlike regular fingerprinting which simply requires an ink pad, a set of fingers and a piece of paper, the method of obtaining genetic profiling is comparatively

²Since the overwhelming percentage (98 percent, according to some studies) of violent crimes are committed by men, the vast majority of DNA cases involve males, rather than females. Thus, the use of the male pronoun in this section seems more appropriate than a female or gender neutral pronoun.

complicated, and requires expensive, sophisticated equipment and computers for analysis. Once start-up costs have been covered, it has, however, become an affordable process.³

Two drawbacks to using the RFLP method are that it requires a larger size sample than other methods of testing, and its vulnerability to problems associated with the sample being degraded by exposure to the environment prior to testing.⁴ A third problem with the use of the RFLP method is the length of time required to generate results: typically several weeks to months.

The following six sections describe how the RFLP genetic print is completed. Essentially, a DNA profile is created through the isolation and comparison of the lengths of several (often six to eight) highly polymorphic loci.⁵

§ 11:14 The RFLP method of creating DNA profiles— Extraction of DNA

The first step in DNA profiling is to extract the DNA from nucleated cells of the evidence sample obtained during the course of an investigation as well as from a reference sample of tissue or blood from the person in question. In order to obtain the DNA sample from the evidence, there must be a blood sample, tissue, bone or commonly a semen sample. The DNA is extracted from the cell in a fairly simple series of steps and the sample is chemically purified for use.

In sexual assault cases, evidentiary samples (e.g., vaginal swabs) often contain mixtures of the perpetrator's semen with epithelial cells of the victim. Forensic laboratories typically perform two extractions on such samples, one designed to obtain DNA from the female epithelial cells, and a second designed to obtain DNA from the semen. This procedure, known as *differential extraction* (also called *differential lysis*), is designed to separate the mixed DNA sample into male

³According to representatives of Cellmark, the cost for RFLP testing never exceeded is \$1,000 per test.

⁴Donald E. Riley, Ph.D., DNA Testing: An Introduction For Non-Scientists, An Illustrated Explanation, 3, at <http://www.scientific.org/tutorials/articles/riley/riley.htm> (hereinafter "Riley, DNA Testing"). Scientific Testimony (<http://www.scientific.org>) is an online journal discussing new and developing forensic DNA and other types of scientific evidence as well as links to new case law on scientific evidence.

⁵RFLP is explained simply in Riley, DNA testing, at 3-4.

and female components. Although the separation is often incomplete (some male DNA may remain in the female component and vice-versa), this procedure can help distinguish contributors to mixed samples.

After extraction, laboratories typically estimate the quantity of DNA in each sample. The amount of DNA required for typing varies for different procedures. RFLP analysis requires the most DNA, typically 50-100 ng. (nanograms)¹. DNA tests that make use of polymerase chain reaction (PCR) can type much smaller quantities of DNA. In theory, PCR-based tests can type the DNA of a single cell, but the manufacturer of a commonly used PCR test kit suggests that the reliability of its test may suffer when the amount of starting DNA is too low. For the DQ-Alpha and Polymarker tests, the manufacturer recommends no less than 2 ng.² For STR testing 1 ng. may be sufficient. Some labs report obtaining results with as little as 100 pg.³ Attempting to type extremely low quantities of DNA increases the danger that minute quantities of human DNA that inadvertently contaminate the samples will be detected, causing spurious results.⁴ It also increases the likelihood that some alleles that are present in the sample will fail to be detected, which could cause the sample to be mistyped.

Laboratories may also check the "molecular weight" of the DNA. In samples that have aged or been exposed to adverse environmental conditions, the DNA becomes degraded, i.e., the long strands (which are said to have high molecular weight) break into shorter, lighter pieces. The extent of degradation determines which testing methods are likely to succeed. RFLP analysis requires DNA of high molecular weight. PCR-based tests can type samples that are some-

[Section 11:14]

¹A nanogram (ng.) is one-billionth of a gram (10⁻⁹ g). A bloodstain of one square centimeter contains approximately 200 ng. of DNA; a bloodstain of one square millimeter contains approximately 2 ng. of DNA. NRC Report, p. 28.

²Cetus Corp. Amplitype User Guide, Version 2 (1990), 6.2.2.

³A picogram (pg.) is one one-thousandth of a nanogram. Hence, 100 pg. = 0.1 ng.

⁴W. Nividi, N. Arnheim, & M. Waterman, A Multiple-Tubes Approach for Accurate Genotyping of Very Small DNA Samples by Using PCR: Statistical Considerations, 50 Am.J.Hum.Genet. 347 (1992).

what more degraded. If the DNA is too degraded, however, no test can type it.

**§ 11:15 The RFLP method of creating DNA profiles—
Fragmentation by restriction enzymes**

Once DNA is extracted, proteins called "restriction enzymes" are used to break long DNA molecules into shorter fragments by cutting them at specific sequences of nucleotides. When a tandemly repeated sequence occurs between two restriction enzyme sites on a DNA molecule the length of the resulting fragment will be determined in part by the number of times that the sequence is tandemly repeated. If the number of repeats differs from one person to the next (is polymorphic) those differences in the length of the resulting fragments can be used as identifying features in the following steps of the procedure. Generally speaking, restriction enzymes either cut DNA to yield fragments of specific length (they generate a result) or they do not (they generate no result) - it is not possible for one DNA profile to be converted to another.

**§ 11:16 The RFLP method of creating DNA
profiles—Gel electrophoresis**

Separating DNA fragments on the basis of their size was and remains to be a very common practice for molecular biologists. The basis of virtually all DNA size fractionation is gel electrophoresis. In this process, DNA fragments are loaded onto small indentations called "wells" at one end of a flat gelatin surface containing agarose gel, a jello-like substance derived from kelp. One end of the gel is attached to a positively charged electrode and at the other to a negatively charged electrode. Because DNA is an intrinsically negatively charged molecule, it moves away from the negative electrode and travels toward the positive electrode. Larger fragments of DNA have more difficulty traveling through the gel's "matrix" (essentially a long series of sieves at a molecular level) than smaller fragments which move more quickly. Fragment sizes for RFLP analyses were typically in the range of between 200 bp and 7,000 bp. One of the problems with agarose gel electrophoresis is its ability to resolve fragments that do not differ in size by at least 20 to 100 bp since such fragments (especially fragments at the

larger end of the typical size range) move so similarly and because of sometimes subtle differences in how quickly DNA moves in one lane of a gel relative to another. As a result, most sizing of fragments for forensic purposes was done by "binning" - essentially saying that a fragment could be said to fall within a certain size range and other fragments that fell within the same size range were said "to match." This "match" would be declared even though the fragments might actually have different numbers of tandem repeats and could not have come from the same individual.

**§ 11:17 The RFLP method of creating DNA profiles—
Southern hybridization and visualization¹**

After their trip through the gel, the double stranded DNA fragments are chemically split into two strands, separating their paired nitrogenous bases from each other (A from T and C from G). These fragments are then directly transferred from the gel (which, like gelatin desserts, is difficult to handle and preserve intact) onto a sheet of a paper-like substance (usually either made of nylon or nitrocellulose) called a "filter" or "membrane." The separated DNA fragments are then permanently attached to the filter either by exposure to ultraviolet light or cross-linking chemicals.

**§ 11:18 The RFLP method of creating DNA profiles—
Hybridization**

A restriction enzyme that recognizes a four nucleotide long restriction site (like *Hae*III mentioned above) should find such a site once every 256 base pairs on average if each of the nucleotides are equally represented in a random sequence. For a 3.2 billion nucleotide sequence such as that of the human genome, cutting with such an enzyme results in literally millions of fragments of a very wide variety of sizes. As a result, the gel electrophoresis of a restriction enzyme digested human genome is best described as a smear of fragments that contains no distinct bands.

[Section 11:17]

¹"Southern Hybridization" is named for Dr. Edward H. Southern, who first developed the process in 1975. See generally Southern, *Detection of Specific Sequences Among DNA Fragments Separated by Gel Electrophoresis*, 98 J Molecular Biology (1975).

The particular bands of interest to forensic scientists are recognized through the use of "probes" that seek out and bond with a locus of interest and no other. The tendency for A's and T's to interact and for G's and C's to interact allows single stranded DNA molecules to be designed that stick more stably to complementary sequences of nucleotides attached to the membrane of the Southern blotting step described above. Probes that are 20 base pairs long or longer are generally specific enough in their binding to interact with just one locus from a genome (such as a polymorphic VNTR locus). Such probes can either be made through the use of recombinant technology,¹ or chemically synthesized. These probes were originally tagged with radioactive markers that made it possible to determine where they had attached to a membrane but safer and more convenient fluorescent markers are also now available. Probes that do not find a complementary sequence to which they can bind are simply washed away while those that do bind give rise to a bar code type of pattern that is characteristic of the VNTR DNA typing methodology.

**§ 11:19 The RFLP method of creating DNA profiles—
Autoradiography and visualization of profiles**

Once a probe is bound to DNA fragments originating from a specific locus, the membrane is placed against a piece of X-ray film and exposed for several days. When the film is developed, black bands appear where the labeled probes stuck to the fragments and the result somewhat resembles the bar codes on products in the store that are put through scanners. (See Figure 1, above). This picture is termed an "autoradiograph" or "autorad."

Each probe identified two fragments (alleles) in each person's DNA, one inherited from the person's mother and the other from the father. A person's genotype, for a given locus, is indicated by the lengths of this pair of fragments. Genotypes vary from person to person because the underlying fragments originate in loci that are where there is considerable variation in the length of restriction fragments.

[Section 11:18]

¹Recombinant DNA technology is the incorporation of all or part of the DNA from one organism into the DNA of another organism--for instance, fragments of DNA from two different species, such as a bacterium and a reptile, spliced into a single molecule.

To reduce the likelihood of a false inclusion (coincidental match) between two samples, forensic laboratories generally used three to five separate probes. They generally applied the probes one at a time. The first probe was applied to the membrane and an x-ray film (*autorad*) was developed showing the resulting patterns of bands, which revealed the length of the restriction fragments from a particular locus (for all the samples on the membrane). Then the first probe was "stripped" from the membrane and a second probe was applied, a second autorad was developed, and so on. In a typical case, three to five probes were used and the results of the analysis were revealed on three to five autorads. If each fragment in one sample had the same length as the corresponding fragment in another sample (within a specified tolerance), the two samples were said to match, which means they could have come from the same person. If one or more fragments in the first sample differed in length (by an amount greater than a specified tolerance) from the corresponding fragment in a second sample, the two samples were declared a non-match (or exclusion), which means they could not have come from the same person.

Bands of evidentiary samples are sized by comparing their position to the position of "marker" bands in adjacent lanes. (See Figure 1). The marker bands are produced by an array of DNA fragments (from bacteria) that vary incrementally in length to produce a "sizing ladder." Sizing may be accomplished by simply measuring with a ruler to determine the position of bands in the various lanes.¹ However, forensic laboratories typically used computer-assisted imaging devices, which can score autorads more rapidly and can automatically perform the calculations needed to estimate the band sizes (fragment lengths) of the samples through interpolation.¹ Once the bands were sized, the *DNA profile* of each sample could be represented by a set of numbers

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¹A band in the same position as a 1000-base-pair "marker," for example, would be "scored" as a 1000-base pair band (meaning that the underlying DNA fragment is estimated to be 1000 base pairs in length). If a band is between two markers, its length is determined by interpolation. These length estimates are sometimes called "band sizes."

¹The use of computer-assisted scoring devices does not necessarily mean that the scoring and sizing of bands is "objective." Analysts are able to override the scorings of computer-assisted devices in order to add or

indicating the estimated length (in base pairs) of the restriction fragments at each locus.

§ 11:20 "Amplification" of DNA Using PCR

The DNA tests currently being used in forensic laboratories all make use of a procedure known as polymerase chain reaction, or PCR. PCR is a procedure that allows a small amount of DNA (which by itself would not be enough to type) to be *amplified* into an amount large enough for typing. It does this by making millions of copies of DNA fragments from a polymorphic area (or areas) of the genome. PCR is not a genetic test itself, but merely a tool to increase the amount of genetic material to be tested.

The "amplification" of DNA takes place in a test tube. The DNA that is extracted from each sample is placed in a separate tube, along with a mixture of *primers*, *enzymes*, and other reagents. The tubes are then placed in a machine known as a thermal cycler, which can control their temperature precisely while going through a series of heating and cooling cycles.

Each cycle has three steps. First, the tubes are heated to approximately 94 degrees Celsius. At this temperature the DNA denatures--that is, the double-stranded molecule "unzips" to form two complementary single strands.

In the second step, the tubes are cooled to about 60 degrees Celsius. At this temperature the primers *anneal* (bond) to the single strands of DNA. The primers are similar to genetic probes. They are single strands of organic bases (nucleotides), synthesized in a laboratory, that are complementary to specific target areas on the single strands of human DNA. The primers are designed to anneal at positions that flank the polymorphic areas to be amplified, thereby marking those areas.

In the third step, the tubes are heated to about 72 degrees Celsius. At this temperature, an enzyme known as Taq DNA polymerase acts as a catalyst, causing single DNA strands in

delete bands based on subjective criteria. Most forensic laboratories fail to document operator overrides of machine scoring determinations, making it impossible to tell whether any given band was scored by objective or subjective criteria. The author's analysis of case work at one laboratory that does document such operator overrides (Cellmark Diagnostics) indicates that they occur frequently.

the areas marked by the primers to attract and bond with complementary bases that are floating in the solution. Each single strand of DNA from the marked areas thus becomes one side of a new double strand. When this process is completed, the number of identical double strands of DNA from the polymorphic areas is twice what it was at the beginning of the cycle.

This three step cycle is repeated 25-35 times, doubling the number of copies of the target DNA each time, and producing literally billions of copies. The target DNA (from a polymorphic area, or areas), which was initially like a needle in a haystack of other DNA, is amplified to the point that there are far more needles than hay, at which point the needles can be typed using a variety of methods.

As a result of its ability to generate usable amounts of material from as little DNA as that which comes from a single cell, PCR-based approaches are amazingly sensitive and have the additional advantage of being much faster than RFLP analysis and better able to generate interpretable results even when evidentiary samples are degraded by exposure to the environment.

It is important to remember that PCR is simply a procedure for replicating DNA. It is not a method for typing DNA, although some courts have used the term incorrectly as a description for the DQ-alpha and Polymarker tests (described below). In fact, PCR is a component of every current DNA typing method.

§ 11:21 "Amplification" of DNA Using PCR—DQ-Alpha and Polymarker Tests

The first method that was developed for typing amplified DNA involved detection of specific sequences of genetic code in the amplified product. Each distinct sequence constitutes an allele, and the alleles were detected by using *allele-specific probes*, which are synthesized strings of organic bases that are complementary to the sequence they are designed to detect.¹ For example, if the target allele contained the

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¹Remember, an allele is one of several alternate forms of a gene concerned with the same trait or characteristic and occupying a given locus on a chromosome. At the loci responsible for determining hair color,

sequence ACCTCG, the probe would have the sequence TGGAGC. Attached to each probe is a molecule that changes color when the probe bonds to its complementary sequence.

The standard method for deploying the probes was to spot them on to nylon test strips, with each probe in a specified location, and then to immerse the test strip in a solution of amplified, denatured DNA.² When one of the probes changed color in the presence of a particular allele, it produced a detectable spot in its place on the strip.³ (See Figure 2 above). By seeing which probes "light up" in this manner and which do not, an analyst can determine which alleles are present in the amplified DNA. The scoring is entirely subjective (and different experts sometimes differ about whether a faint dot is truly present), but analysts typically photographed the strips in order to have a record of their observations.⁴

In 1991, Perkin-Elmer (PE) introduced a test kit for amplifying and typing alleles of the HLA (Human Leukocyte Antigen) DQ-alpha gene.⁵ Fragments of DNA from the ap-

for example, there may be alleles whose combination results in blond or red hair. The alleles for blond hair would contain similar, but measurably different information content relative to those that give rise to red hair.

²The amplification process is stopped at a point when the DNA is denatured (in single strands) so that the probes will be able to bind with their target sequences.

³This approach is often aptly referred to as a "reverse dot blot" approach (DNA fragments of interest are washed over probes attached to a membrane) - unlike the more conventional VNTR approach that relies upon "direct blot hybridization" (where probes are washed over DNA fragments of interest that have been attached to a membrane).

⁴A photograph is an important form of documentation because the strips themselves fade over time, making it impossible, in the absence of a photograph, for an independent analyst to check the scoring.

⁵See Edward Blake, Jennifer Mihalovich, Russell Higuchi, P.S. Walsh & Henry Erlich, Polymerase Chain Reaction (PCR) Amplification and Human Leukocyte Antigen (HLA)-DQ Oligonucleotide Typing on Biological Evidence Samples: Casework Experience, 37 J.Forensic Sci. 700 (1992); George Sensabaugh and Cecilia Von Beroldingen, The Polymerase Chain Reaction: Application to the Analysis of Biological Evidence, in M. Farley & J. Harrington, Forensic DNA Technology, 1991. The HLA DQ-alpha gene is an area of DNA on chromosome 6 that controls leukocyte (white blood cell) antigens. These antigens are important in tissue typing for organ transplantation.

appropriate area were amplified using PCR and then exposed to test strips containing the probes.⁶

The DQ-alpha test was far less discriminating than RFLP tests: it could detect only seven different alleles of a single gene. Each person inherits two alleles, one from each parent, therefore the test could distinguish 28 different genotypes.⁷ The frequency of the various genotypes in the population ranges from about one to fifteen percent, making the likelihood of a coincidental match between different samples much higher than with RFLP tests. But the DQ-alpha test was far more sensitive than RFLP procedures, allowing it to "type" samples that are much smaller and older.⁸ For example, there is sometimes enough DNA in the dried saliva on a cigarette butt to be typed using the DQ-alpha test.

In 1993, PE introduced an improved kit that typed DQ-alpha and five additional genes, thereby improving the specificity of this method (See Figure 3).⁹ With this new kit, known as the Polymarker/DQ-alpha test, individual profile frequencies were on the order of one in tens of thousands, however it still was not as discriminating as RFLP analysis.

The PE kits were widely used by forensic laboratories in the mid 1990s, but were gradually supplanted by STR tests beginning in about 1998. Commercial test kits for DQ-alpha and Polymarker testing have not been produced since 2002. However, a few labs still maintain stocks of the test strips to allow new samples to be compared to the results of these older tests. Because STR tests examine different loci, using a

⁶The trade name for the test is the Amplitype HLA DQ alpha Forensic DNA Amplification and Typing Kit (Amplitype Kit, for short).

⁷The seven alleles are labeled 1.1, 1.2, 1.3, 2, 3, 4.1 and 4.2/4.3. One allele is inherited from each parent, therefore the 28 possible genotypes a person might have are 1.1,1.1; 1.2,1.2; 1.3,1.3; 2,2; 3,3; 4.1,4.1; 4.2/4.3,4.2/4.3; 1.1,1.2; 1.1,1.3; 1.1,2; 1.1,3; 1.1,4.1; 1.1,4.2/4.3; 1.2,1.3; 1.2,2; 1.2,3; 1.2,4.1; 1.2,4.2/4.3; 1.3,2; 1.3,3; 1.3,4.1; 1.3,4.2/4.3; 2,3; 2,4.1; 2,4.2/4.3; 3,4.1; 3,4.2/4.3; 4.1, 4.2/4.3. An early version of the test did not subtype the 4 allele, and therefore had only 21 genotypes.

⁸Russell Higuchi, Cecelia von Beroldingen, George Sensabaugh & Henry Erlich, DNA Typing from Single Hairs, *Nature* 332:543 (1988).

⁹See, B. Budowle, J. Lindsey, J. DeCou, B. Koons, A. Giusti, & C. Comey, Validation and Population Studies of the Loci LDLR, GYPA, HBGG, D7S8, and Gc (PM loci), and HLA-DQ alpha Using a Multiplex Amplification and Typing Procedure, 40 *J.Forensic Sci.* 45 (1995).

different method, one cannot make comparisons among samples across methods.

§ 11:22 Short Tandem Repeats (STRs)¹

In most forensic laboratories, STR testing has now supplanted both RFLP analysis and DQ-alpha/polymarker testing. STR tests offer the high sensitivity of PCR-based methods and have discriminating power as great as RFLP tests. And they can produce results in as little as one day. Most laboratories are using commercially available STR testing kits that permit simultaneous testing of STR markers at nine to fifteen loci (plus one, Amelogenin, that is useful for sex determination).

§ 11:23 Short Tandem Repeats (STRs)— Understanding the Lab Report in an STR Case

The first item a lawyer sees in a DNA case is typically the lab report. The report generally states what samples were tested, what type of DNA test was performed, and which samples could (and could not) have a common source. Reports generally also provide a "table of alleles" showing the *DNA profile* of each sample. The *DNA profile* is a list of the *alleles* (genetic markers) found at a number of loci (plural for "locus," a position) within the human genome. To understand DNA evidence, you must first understand the table of alleles.

Figure 4 shows a table of alleles, as represented in a typical lab report concerning STR testing. This table shows the DNA profiles of five samples—blood from a crime scene and reference samples from four suspects. These samples were tested with an automated instrument called the ABI Prism 310 Genetic Analyzer(tm) using a set of genetic probes called ProfilerPlus(tm). A company called Applied Biosystems, Inc. (ABI) developed this system for typing DNA. It is currently the most widely used method for forensic DNA typing in the

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¹For more background information on STR testing, see John M. Butler, *Forensic DNA Typing: Biology and Technology Behind STR Markers* (2001).

United States, used by about 85% of laboratories that do forensic DNA testing.¹

Across the top of the table are the names of the various loci examined by the test. The ProfilerPlus(tm) system examines ten loci. (Labs sometimes also run another set of genetic probes, called Cofiler(tm), which includes four additional loci). The alleles that the test detected at each locus are identified numbers. Thus, at locus D3S1358, the test detected alleles 15 and 16. At each locus, a person has two alleles, one inherited from each parent. In some cases, only one allele is detected, which is interpreted as meaning that by chance the person inherited the same allele from each parent. (See in Figure 4, e.g., Suspect 2's profile at locus D3S1358 and Suspect 4's profile at locus D8S1179). However, most samples will have two different alleles at each locus, as seen in Figure 4.

Figure 4: Table of Alleles. Which suspect is a possible source of the blood? Only one of the four suspects has a DNA profile that matches the DNA profile observed in the blood sample.

	D3S1358	VWA	FGA	Amb	D8S1179	21S11	D18S51	D5S81	D13S31	D7S820
Blood	15, 16	15, 15	25, 26	XY	12, 13	27, 30	13, 14	10, 11	9, 12	10, 12
Suspect 1	16, 18	15, 16	21, 24	XY	12, 14	27, 28	13, 17	11, 12	8, 11	8, 12
Suspect 2	15, 15	18, 18	19, 23.2	XY	13, 15	29, 30	17, 17	11, 11	8, 9	9, 10
Suspect 3	15, 16	15, 15	25, 26	XY	12, 13	27, 30	13, 14	10, 11	9, 12	10, 12
Suspect 4	16, 16	16, 17	19, 24	XY	14, 14	30, 30	13, 16	9, 11	10, 11	9, 10

Each allele is a short fragment of DNA from a specific location on the human genome known as an STR (short tandem repeat). STRs are places in human DNA where a short section of the genetic code repeats itself. Everyone has

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¹Bureau of Justice Statistics, Survey of DNA Crime Laboratories, 2001. National Institute of Justice, NCJ 191191, January 2002. <http://www.ojp.usdoj.gov/bjs/pub/pdf/sdnacl01.pdf>

these repeating segments, but the number of repetitions (and hence the length of these segments) varies among individuals. The numbers assigned to the alleles indicate the number of repetitions of the core sequence of genetic code. ProfilerPlus(tm) identifies and labels fragments of DNA that contain STRs. The Genetic Analyzer then measures their length and thereby determines which alleles are present.

By examining the DNA profiles, one can tell whether each suspect could or could not have been the source of the blood. Suspects 1, 2 and 4 are ruled out as possible sources because they have different alleles than the blood at one or more loci. However, Suspect 3 has exactly the same alleles at every locus, which indicates he could have been the source of the blood. In a case like this, the lab report will typically say that Suspects 1, 2 and 4 are "excluded" as possible sources of the blood, and that Suspect 3 "matches" or is "included" as a possible donor.

One of the loci analyzed is called amelogenin (Amel) and is used for typing the sex of a contributor to a sample. Males have X and Y versions of the alleles at that locus; females have only the X because they inherit two copies of the X chromosome. All of the profiles shown in Figure 4 appear to be of males.

Lab reports generally also contain estimates of the statistical frequency of the matching profiles in various reference populations (which are intended to represent major racial and ethnic groups). Crime labs compute these estimates by determining the frequency of each allele in a sample population, and then compounding the individual frequencies by multiplying them together. If 10 percent (1 in 10) of Caucasian Americans are known to exhibit the 14 allele at the first locus (D3S1358) and 20 percent (1 in 5) are known to have the 15 allele, then the frequency of the pair of alleles would be estimated as $2 \times 0.10 \times 0.20 = 0.04$, or 4 percent among Caucasian Americans. The frequencies at each locus are simply multiplied together (sometimes with a minor modification meant to take into account the possibility of under-represented ethnic groups), producing frequency estimates for the overall profile that can be staggeringly small: often on the order of 1 in a billion to 1 in a quintillion, or even less. Needless to say, such evidence can be very impressive.

When the estimated frequency of the shared profile is very low, some labs will simply state "to a scientific certainty"

that the samples sharing that profile *are* from the same person. For example, the FBI laboratory will claim two samples *are* from the same person if the estimated frequency of the shared profile among unrelated individuals is below one in 260 billion. Other labs use different cut off values for making identity claims. All of the cut-off values are arbitrary: there is no scientific reason for setting the cut off at any particular level just as there is no formally recognized way of being "scientifically certain" about anything. Moreover, these identity claims can be misleading because they imply that there could be no alternative explanation for the "match," such as laboratory error, and they ignore the fact that close relatives are far more likely to have matching profiles than unrelated individuals. They can also be misleading in that the DNA tests themselves are powerless to provide any insight into the circumstances under which the sample was deposited and are generally unable to determine the type of tissue that was involved.

§ 11:24 Short Tandem Repeats (STRs)—The Role of Subjective Judgment in STR Testing

Many lawyers simply accept lab reports at face value without looking behind them to see whether the actual test results fully support the laboratory's conclusions. This can be a serious mistake. Examination of the underlying laboratory data sometimes reveals limitations or problems that would not be apparent from the laboratory report, such as inconsistencies between purportedly "matching" profiles, evidence of additional unreported contributors to evidentiary samples, errors in statistical computations and unreported problems with experimental controls that raise doubts about the validity of the results. Yet forensic DNA analysts report that they receive discovery requests from defense lawyers in only 10-15 percent of cases in which their tests incriminate a suspect.

Although STR tests rely heavily on computer-automated equipment, the interpretation of the results often requires subjective judgment. When faced with an ambiguous situation, where the call could go either way, crime lab analysts

frequently slant their interpretations in ways that support prosecution theories.¹

Part of the problem is that forensic scientists refuse to take appropriate steps to "blind" themselves to the government's expected (or desired) outcome when interpreting test results. We often see indications, in the laboratory notes themselves, that the analysts are familiar with facts of their cases, including information that has nothing to do with genetic testing, and that they are acutely aware of which results will help or hurt the prosecution team. A DNA analyst in one case wrote:

Suspect-known crip gang member--keeps 'skating' on charges--never serves time. This robbery he gets hit in head with bar stool--left blood trail. [Detective] Miller wants to connect this guy to scene w/DNA . . .

In another case, where the defense lawyer had suggested that another individual besides the defendant had been involved in the crime, and might have left DNA, the DNA laboratory notes include the notation: "Death penalty case. Need to eliminate [other individual] as a possible suspect."

It is well known that people tend to see what they expect (and desire) to see when they evaluate ambiguous data.² This tendency can cause analysts to unintentionally slant their interpretations in a manner consistent with prosecution theories of the case. Furthermore, some analysts appear to rely on non-genetic evidence to help them interpret DNA test results. When an analyst's interpretation of a problematic case was questioned, the analyst defended her position by saying: "I know I am right--they found the victim's purse in [the defendant's] apartment." Backwards reasoning of this type (i.e., "we know the defendant is guilty, so the DNA evi-

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¹See, William C. Thompson, Subjective Interpretation, Laboratory Error and the Value of DNA Evidence: Three Case Studies, 96 *Genetica* 153 (1995); William C. Thompson, Accepting Lower Standards: The National Research Council's Second Report on Forensic DNA Evidence, 37 *Jurimetrics* 405 (1997); William C. Thompson, Examiner Bias in Forensic RFLP Analysis, *Scientific Testimony: An Online Journal*: www.scientific.org.

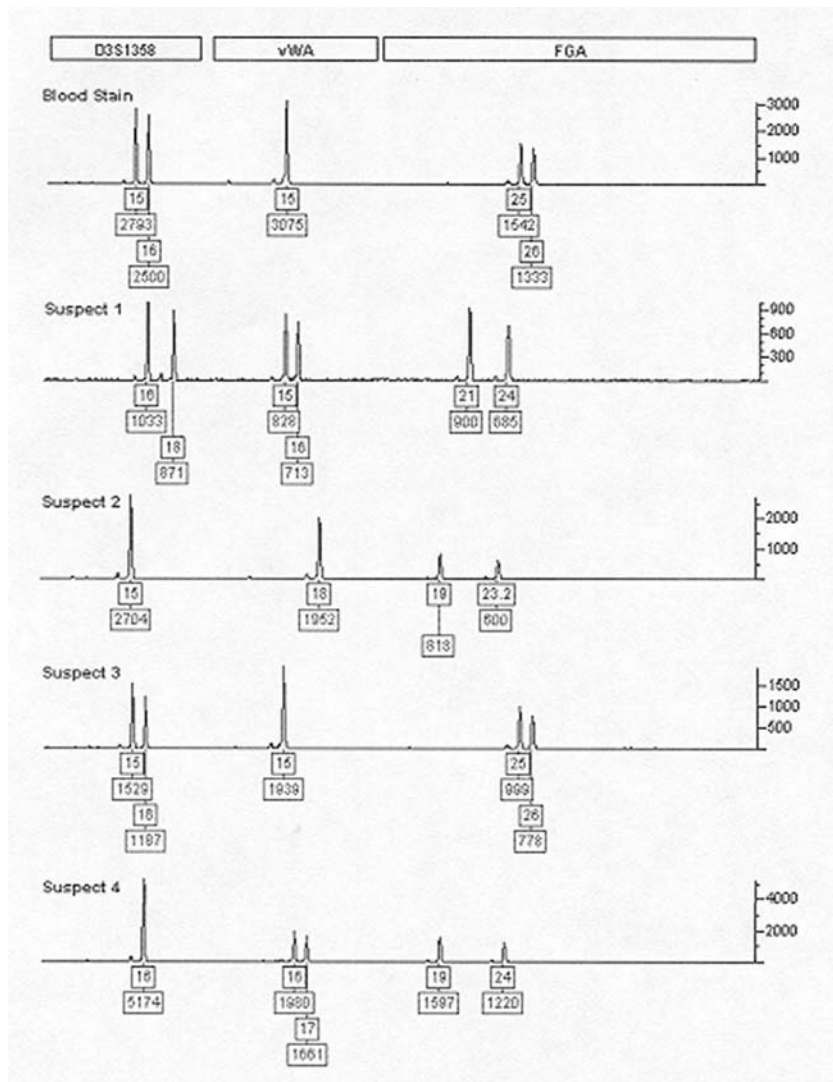
²See D. Michael Risinger, Michael J. Saks, William C. Thompson, & Robert Rosenthal, The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion, 90 *Cal.L.Rev.* 1 (2002).

dence must be incriminating") is another factor that can cause analysts to slant their reports in a manner that supports police theories of the case. Hence, it is vital that defense counsel look behind the laboratory report to determine whether the lab's conclusions are well supported, and whether there is more to the story than the report tells.

§ 11:25 STR Electropherograms

Behind the Table of Alleles (Figure 4) is a set of computer-generated graphs called *electropherograms* that display the test results. When evaluating STR evidence, a lawyer should always examine the electropherograms because they sometimes reveal unreported ambiguities and, fairly frequently, evidence of additional, unknown contributors. The electropherograms shown in Figure 5 display the results for the crime scene blood and four suspects discussed above at three of the ten loci summarized in Figure 4.

Figure 5: Electropherograms Showing the Results of ProfilerPlus(tm) Analysis of Five Samples at Three Loci (D3S1358, vWa and FGA). Which suspect is a possible source of the blood? Boxes immediately below the peaks label the name of the alleles seen while boxes below indicate their heights in RFUs.



The "peaks" in the electropherograms indicate the presence of human DNA. The peaks on the left side of the graphs represent alleles at locus D3S1358; those in the center represent alleles at locus vWA; and those on the right represent alleles at locus FGA. The numbers under each peak are computer-generated labels that indicate which allele each peak represents and how high the peak is relative to the baseline.

By examining the electropherograms in Figure 5, one can readily see that the computerized system detected two alleles in the blood from the crime scene at locus D3S1358. These are alleles 15 and 16, which are reported in the Table of Alleles (Figure 4). The other alleles reported in the allele chart (Figure 4) can also be seen. Our initial examination of these electropherograms reveals no obvious problems of interpretation in this case.

ProfilerPlus(tm) uses "primers" to identify the relevant STR-DNA segments and then "amplifies" (replicates) these segments using a process called polymerase chain reaction (PCR). Each locus is "labeled" with a colored dye (either blue, yellow or green). The Genetic Analyzer measures the length of the DNA segments by using an electrical current to impel them through a narrow capillary tube, wherein the shorter fragments move more quickly than the longer fragments.¹ Under laser light, the colored dyes produce florescent light, signaling the presence of DNA. A computer-operated camera detects the light as the fragments reach the end of the capillary. The "peaks" on the electropherogram record these flashes of light. Based on the color of the light, and the time it took the DNA to pass through the capillary, a series of computer programs determines which alleles are present at each locus.

Figure 5 show the results for three loci that were labeled with blue dye. The position of the peaks on the graph (how far left or right) indicates how long it took the allele to pass through the capillary, which indicates the length of the underlying DNA fragment. From this, the computer program infers which allele is represented and generates the appropriate label.

The height of the peaks corresponds to the quantity of

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¹The most commonly used capillary electrophoresis instruments are produced by a company called Applied Biosystems, Inc. and include the ABI 310 and ABI 3100 Genetic Analyzer machines. While its start up costs are much greater (costing many tens of thousands of dollars vs. several hundred dollars), capillary electrophoresis has several advantages over agarose gel electrophoresis including: greater resolving power (the length of DNA fragments between 30 and 1,000 bp can be determined precisely); very small amounts of PCR amplification product are needed; the loading of capillaries is easily automated; and the relative amounts of different DNA fragments can be easily quantitated.

DNA present. The unit of measurement for peak heights is the RFU, or "relative fluorescent unit," which reflects the intensity of the fluorescent light detected by the computer-operated camera. Peaks representing alleles from the same person are expected to have roughly the same heights measured in RFUs throughout a given sample, although *peak height imbalances* occasionally occur.

§ 11:26 Short Tandem Repeats (STRs)—Sources of Ambiguity in STR Interpretation

A number of factors can introduce ambiguity into STR evidence, leaving the results open to alternative interpretations. To competently represent an individual incriminated by DNA evidence, defense counsel must uncover these ambiguities, when they exist, understand their implications, and explain them to the trier-of-fact.

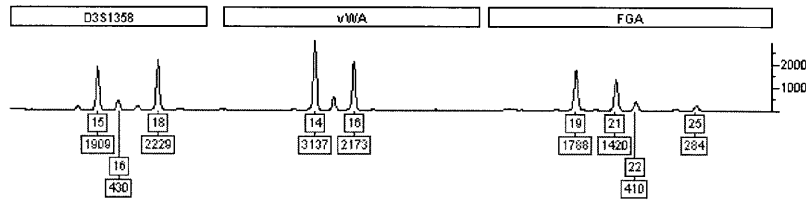
A. Mixtures. One of the most common complications in the analysis of DNA evidence is the presence of DNA from multiple sources. A sample that contains DNA from two or more individuals is referred to as a *mixture*. A single person is expected to contribute at most two alleles for each locus. If more than two peaks are visible at any locus, there is strong reason to believe that the sample is a mixture.

By their very nature mixtures are difficult to interpret. The number of contributors is often unclear. Although the presence of three or more alleles at any locus signals the presence of more than one contributor, it often is difficult to tell whether the sample originated from two, three, or even more individuals because the various contributors may share many alleles. If alleles 14, 15 and 18 are observed at a locus, they could be from two individuals, A and B, where A contributed 15 and B contributed 14, 18. Alternatively, A could have contributed 14, 15 while B contributed 15, 18, and so on. There might also be three contributors. For example A could have contributed 14, 15, while B contributed 15, 18 and C contributed 15. Many other combinations are also consistent with the findings. A study of one database of 649 individuals found over 5 million three-way combinations of individuals that would have shown four or fewer alleles across all 12 commonly tested STR loci.¹

Figure 6: Presence of more than two alleles at a locus indicates a mixture

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¹For more information about this study, contact Dan Krane.



Some laboratories try to determine which alleles go with which contributor based on peak heights. They assume that the taller peaks (which generally indicate larger quantities of DNA at the start of the analysis) are associated with a "primary" contributor and the shorter peaks with a "secondary" contributor. In Figure 6, for example, a laboratory analyst might conclude that a "primary contributor" is responsible for alleles 15 and 18 at locus D3S1358 and alleles 19 and 21 at locus FGA, while a "secondary contributor" is responsible for allele 16 at D3S1358 and alleles 22 and 25 at locus FGA. But inferences of this kind are often problematic because a variety of factors, other than the quantity of DNA present, can affect peak height. Moreover, labs are often inconsistent in the way they make such inferences, treating peak heights as a reliable indicator of DNA quantity when doing so supports the government's case, and treating them as unreliable when it does not.

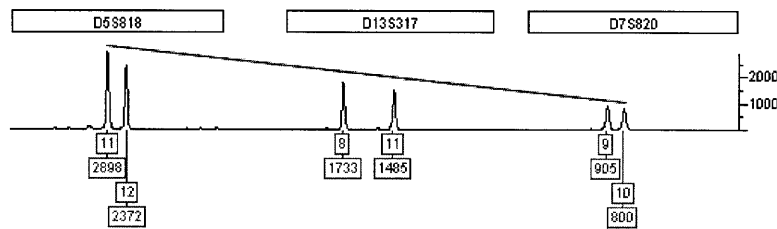
These interpretive ambiguities make it difficult, and sometimes impossible, to estimate the statistical likelihood that a randomly chosen individual will be "included" (or, could not be "excluded") as a possible contributor to a mixed sample. Lawyers should look carefully at the way in which laboratories compute statistical estimates in mixture cases because these estimates often are based on debatable assumptions that are unfavorable to the defendant.

B. Degradation. As samples age, DNA like any chemical begins to break down (or degrade). This process occurs slowly if the samples are carefully preserved but can occur rapidly when the samples are exposed for even a short time to unfavorable conditions, such as warmth, moisture or sunlight.

Degradation skews the relationship between peak heights and the quantity of DNA present. Generally, degradation produces a downward slope across the electropherograms in the height of peaks because degradation is more likely to

interfere with the detection of longer sequences of repeated DNA (the alleles on the right side of the electropherogram) than shorter sequences (alleles on the left side).

Figure 7: The progressively smaller peak heights in this sample from left to right are indicative of degradation

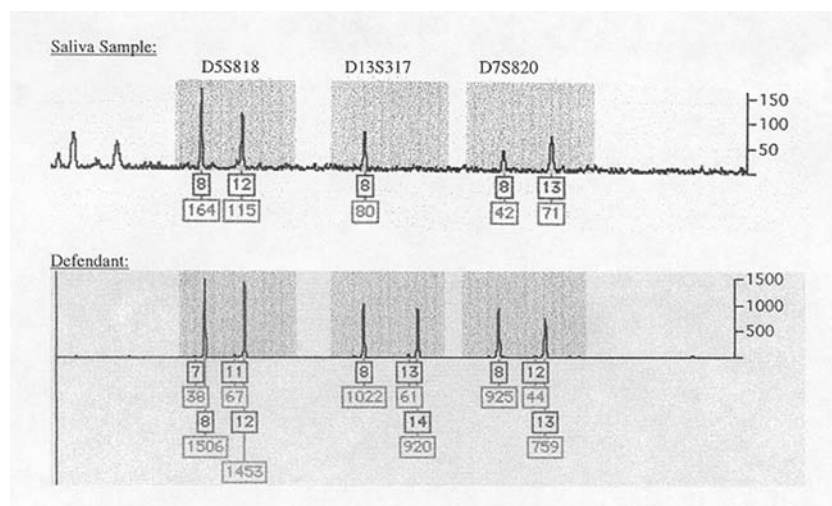


Degraded samples can be difficult to type. The process of degradation can reduce the height of some peaks, making them too low to be distinguished reliably from background "noise" in the data, or making them disappear entirely, while other peaks from the same sample can still be scored. In mixed samples, it may be impossible to determine whether the alleles of one or more contributors have become undetectable at some loci. Often analysts simply guess whether all alleles have been detected or not, which renders their conclusions speculative and leaves the results open to a variety of alternative interpretations. Further, the two or more biological samples that make up a mixture may show different levels of degradation, perhaps due to their having been deposited at different times or due to differences in the protection offered by different cell types. Such possibilities make the interpretation of degraded mixed sample particularly prone to subjective (unscientific) interpretation.

C. **Allelic Dropout.** In some instances, an STR test will detect only one of the two alleles from a particular contributor at a particular locus. Generally this occurs when the quantity of DNA is relatively low, either because the sample is limited or because the DNA it contains is degraded, and hence the test is near its threshold of sensitivity. The potential for allelic dropout complicates the process of interpretation because analysts must decide whether a mismatch between two profiles reflects a true genetic difference or simply the failure of the test to detect all of the alleles in one of the samples.

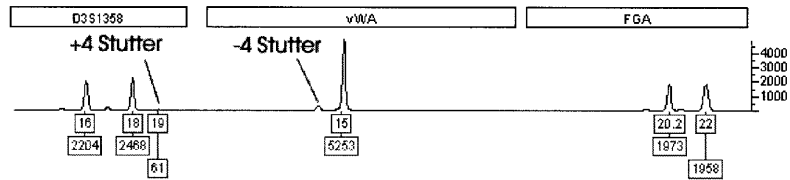
Figure 8 shows three loci from a case in which a defendant's profile was "matched" to the profile of a saliva sample from a woman's breast. The laboratory reported that the DNA profile of the saliva sample shown in Figure 8 was consistent with the defendant's profile, despite the absence of the defendant's 14 allele at locus D13S317 because the analyst assumed that the 14 allele had "dropped out." However, the occurrence of "allelic dropout" cannot be independently verified—the only evidence that this phenomenon occurred is the "inconsistency" that it purports to explain. Obviously, there is another possible interpretation that is more favorable for this defendant—i.e., that police arrested the wrong man.

Figure 8: Allelic Dropout or the Wrong Man?



D. Spurious Peaks. An additional complication in STR interpretation is that electropherograms often exhibit spurious peaks that do not indicate the presence of DNA. These extra peaks are referred to as "technical artifacts" and are produced by unavoidable imperfections of the DNA analysis process. The most common artifacts are *stutter peaks*, *noise* and *pull-up*.

Figure 9: This electropherogram contains technical artifacts called stutter that may mask the presence of true alleles present in an evidence sample.



Stutter peaks are small peaks that occur immediately before (and, less frequently, after) a real peak. Stutter occurs as a by-product of the process used to amplify DNA from evidence samples. In samples known to be from a single source, stutter is identifiable by its size and position. However, it is sometimes difficult to distinguish stutter bands from a secondary contributor in samples that contain (or might contain) DNA from more than one person.

Noise is the term used to describe small background peaks that occur along the baseline in all samples. A wide variety of factors (including air bubbles, urea crystals, and sample contamination) can create small random flashes that occasionally may be large enough to be confused with an actual peak or to mask actual peaks.

Pull-up (sometimes referred to as bleed-through) represents a failure of the analysis software to discriminate between the different dye colors used during the generation of the test results. A signal from a locus labeled with blue dye, for example, might mistakenly be interpreted as a yellow or green signal, thereby creating false peaks at the yellow or green loci. Pull-up can usually be identified through careful analysis of the position of peaks across the color spectrum, but there is a danger that pull-up will go unrecognized, particularly when the result it produces is consistent with what the analyst expected or wanted to find.

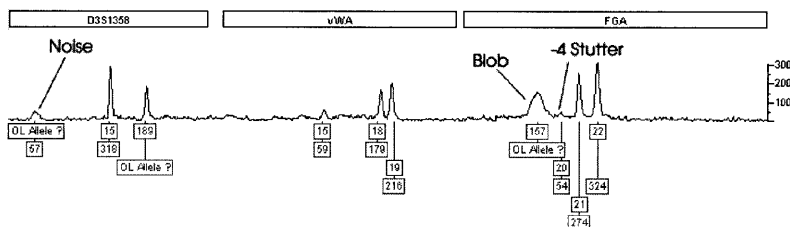
Although many technical artifacts are clearly identifiable, standards for determining whether a peak is a true peak or a technical artifact are often rather subjective, leaving room for disagreement among experts. Furthermore, analysts often appear inconsistent across cases in how they apply interpretive standards-accepting that a signal is a "true peak" more readily when it is consistent with the expected result than when it is not. Hence, these interpretations need to be examined carefully.

Spikes, blobs and other false peaks. A number of different

technical phenomena can affect genetic analyzers, causing spurious results called "artifacts" to appear in the electropherograms. *Spikes* are narrow peaks usually attributed to fluctuation in voltage or the presence of minute air bubbles in the capillary. Spikes are usually seen in the same position in all four colors. *Blobs* are false peaks thought to arise when some colored dye becomes detached from the DNA and gets picked up by the detector. Blobs are usually wider than real peaks and are typically only seen in one color. The "OL Allele" shown in Figure 10 below may be a blob.

Spikes and blobs are not reproducible, which means that if the sample is run through the genetic analyzer again these artifacts should not re-appear in the same place. Hence, the correct way to confirm that a questionable peak is an artifact is to rerun the sample. However analysts, to save time, often simply rely on their "professional experience" to decide which results are spurious and which are real. This practice can be problematic because no generally accepted objective criteria have yet been established to discriminate between artifacts and real peaks (other than retesting).

Figure 10: Blobs and other false peaks may hide the presence of true alleles.



Threshold Issues: Short Peaks, "Weak" Alleles. *When the quantity of DNA being analyzed is very low (as indicated by low peak-heights), the genetic analyzer may fail to detect the entire profile of a contributor. Furthermore, it may be difficult to distinguish true low-level peaks from technical artifacts. Consequently, most forensic laboratories have established peak-height thresholds for "scoring" alleles. Only if the peak-height (expressed in RFU) exceeds a standard value will it be counted.*

There are no generally accepted thresholds for how high

peaks must be to qualify as a "true allele." Applied Biosystems, Inc., which sells the most widely used system for STR typing (the ABI Prism 310 Genetic Analyzer(tm) with the ProfilerPlus(tm) system) recommends a peak-height threshold of 150 RFU, saying that peaks below this level must be interpreted with caution. However, many crime laboratories that use the ABI system have set lower thresholds (down to 40 RFU in some instances). And crime laboratories sometimes apply their standards in an inconsistent manner from case to case or even within a single case. Hence, a defendant may be convicted in one case based on "peaks" that would not be counted in another case, or by another lab. And in some cases there may be unreported peaks, just below the threshold, that would change the interpretation of the case if considered.

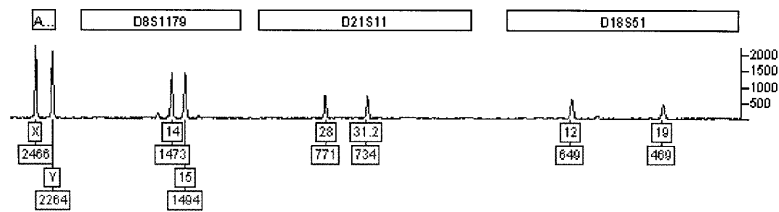
Finding and evaluating low-level peaks can be difficult because labs can set their analytic software to ignore peaks below a specified level and can print out electropherograms in a manner that fails to identify low-level alleles. The best way to assess low-level alleles is to obtain copies of the electronic data files produced by the genetic analyzer and have them re-analyzed by an expert who has access to the analytic software.

Figure 11 shows electropherograms from a rape/homicide case. The defendant admitted having intercourse with the victim, but contended another man had subsequently raped and killed her. The crime lab reported finding only the defendant's profile in vaginal samples from the victim; the lab report stated that the second man was "excluded" as a possible source of the semen collected from the victim's body. However, a review of the electronic data by a defense expert revealed low-level alleles (peaks) consistent with those of the second man, which significantly helped the defense case. Notice how these low-level alleles are obscured in the upper electropherogram (which the lab initially provided in response to a discovery request) due to the use of a large scale (0-2000 RFU) on the Y-axis. These low peaks are revealed in the lower electropherogram, where the defense expert set the software with a lower threshold of detection and produced an electropherogram with a lower scale (0-150 RFU).

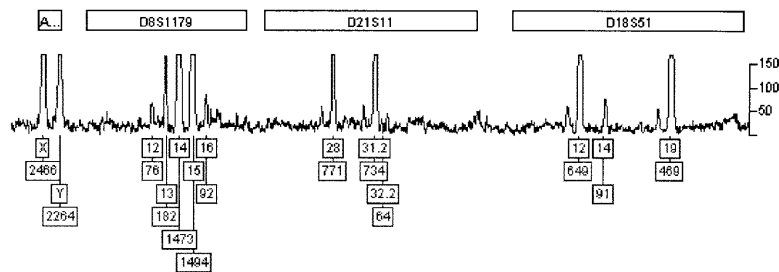
Figure 11: Defense Examination of Electronic Data Reveals Second Contributor to Vaginal Sample (After Crime Lab Reported the Second Man Had Been "Excluded")

	D8S1179	D21S11	D18S51
Defendant	14,15	28, 31.2	12,19
Second Man	13,16	28, 32.2	14,14

Vaginal Swab Profile (Showing Alleles Consistent with Defendant, but None Consistent with Second Man)



Vaginal Swab Profile After Defense Reanalysis of Electronic Data (Showing Additional Low-Level Alleles Consistent with "Excluded" Man)



§ 11:27 Short Tandem Repeats (STRs)—Reviewing Electronic Data in STR Cases

Reviewing the electronic files produced by the ABI Prism 310 Genetic Analyzer(™) (or similar equipment) has a number of additional benefits beyond revealing unreported low-level peaks. The software that controls these devices creates a complete record of all operations the device performs while typing samples in a particular case and records the results for each sample.

These records can reveal a variety of problems in testing that a forensic laboratory may fail to notice or choose not to report, such as failure of experimental controls, multiple

testing of samples with inconsistent results, re-labeling of samples (which can flag potential sample mix-ups or uncertainty about which sample is which), and failure to follow proper procedures. In some cases review of electronic data has revealed that the laboratory failed to run all of the necessary control samples needed to verify the reliability of the test results, or that the laboratory ran the control samples under different conditions than the analytical samples (a major breach of good scientific practice).

The electronic files are also useful for producing trial exhibits. An expert with the right software can convert the files from their proprietary format into Adobe Acrobat files containing images that can easily be inserted into Powerpoint and Microsoft Word documents.

It is easy for crime laboratories to produce the electronic data that underlie their conclusions. All that is necessary is to copy the files produced in the case onto a CD-ROM, or other storage medium. CD-ROMs are generally preferred because they create an unalterable record of the data produced by the laboratory. Copying files to a CD-ROM is a simple point and click operation that can be accomplished in fifteen minutes or less in most cases. CD-ROM burners compatible with any laboratory computer are available commercially for under \$200. There is no legitimate excuse for refusing to turn over electronic data for defense review. In a few instances laboratories have resisted producing electronic files, or have even destroyed the files, but the great majority of trial courts will not tolerate such obstructive behavior.

The electronic data produced by the ABI 310 Genetic Analyzer(tm) is in a proprietary format that can only be read and interpreted by ABI's Genescan(tm) and Genotyper(tm) software. Defense lawyers seeking a review of electronic data must find an expert who has access to this software. The review process typically takes a minimum of 3-4 hours, and may take much longer in an even moderately complicated case. The recent development of "expert system" software for analyzing Genescan(tm) and Genotyper(tm) data provides another option for analysis of electronic data.¹

§ 11:28 [Reserved]

[Section 11:27]

¹One option for review of electronic data is a service provided by Forensic Bioinformatics Services (FBS). FBS uses Genescan(tm) and

§ 11:29 [Reserved]

§ 11:30 Y chromosome STRs

The sex of an individual is determined by which pair of sex chromosomes they inherit - either an X and a Y (male) or two X's (female). A genetic marker associated with these two sex chromosomes, Amelogenin, is commonly examined to determine if the contributors to a sample include a male since a distinctive version of the locus is found on Y chromosomes. Very recently, a set of STR markers associated with just the Y chromosome have also been developed and their use has been validated by several laboratories. Like conventional STR markers, the loci are amplified in multiplex reactions where they are labeled with color dyes that allow the amplification products to be typed by a Genetic Analyzer. Since women do not have Y chromosomes as part of their genetic material, Y-STR typing has the promise of being useful in situations where it is necessary to unambiguously determine what a male has contributed to a mixed sample (i.e. those collected as part of most rape investigations). Unlike conventional STRs (sometimes called "autosomal STRs" to distinguish them from Y-STRs), where two alleles per locus is the norm, each version of a Y-STR is normally represented only once in each male. Further, these markers all travel from generation to generation as part of a single chromosome that never has an opportunity to ex-

Genotyper(tm) to analyze electronic data according to a systematic protocol that was designed to detect ambiguities, problems, and evidence supporting alternative interpretations. FBS is able to do the work at relatively low cost by using an automated "expert system" called Genophiler(tm). Genophiler(tm) is a computer program that operates Genescan and Genotyper the way a highly sophisticated human operator would--but faster and more systematically. Genophiler(tm) extracts all necessary information, analyzes it, and produces various reports of its results.

Lawyers can use these reports to rapidly determine whether there are any significant issues or problems in a case. Defense experts can use these reports as a basis for their own analysis and assessment of the case. All of the electropherograms and other critical data are automatically converted to Adobe Acrobat format, so that the defense expert need not have access to Genescan(tm) and Genotyper(tm) software to review and evaluate the electronic files. An example of Genophiler's(tm) outputs and reports can be found at the FBS web site at www.bioforensics.com.

Dan Krane, one of the authors of this chapter, is president of FBS. William Thompson, another author, has a financial interest in this company.

change information with another Y chromosome. This associated pattern of inheritance undermines the logical foundation for using the product rule (described in § 11:21) to estimate the chance of coincidental matches with other possible male contributors. As a result, the rarity of Y-STR profiles must be determined by empirical studies (i.e. a particular combination of alleles was observed only three times in a sampling of 300 males, therefore it is expected to occur with a frequency of approximately one in 100) and the associated statistics are (and will remain) far less impressive than those generated with conventional STR testing.

§ 11:31 Mitochondrial DNA sequencing

When viewed with a microscope, mitochondria are among the most prominent organelles within human cells. They are primarily known for the central role that they play in the generation of metabolic energy. In humans (and most animals), mitochondria are exclusively inherited through the mother because eggs (and not sperm) are the major contributor of cytoplasm to zygotes. A typical human cell contains between 1,000 and 10,000 mitochondria to satisfy its energy-production needs. Each of these mitochondria contains a copy of the mitochondrial genome which is very small in comparison to the nuclear genome where STR loci are found (16,569 bp vs. 3.2 billion bp for the genome overall). Within that relatively small genome is a stretch of nucleotides called the "mitochondrial D-loop" that tends to differ in its particular sequence of nucleotides (but not its length) from one maternal lineage to another. Analyses of the mitochondrial D-loop sequences have been very useful to biologists studying the migration patterns of humans and other mammals. From a forensic perspective, the presence of 1,000 to 10,000 more copies of mitochondrial DNA than nuclear DNA per cell gives analyses of it a distinct advantage in situations where a sample is not expected to have much DNA associated with it (i.e. a hair shaft or a fingerprint) or the DNA within a sample is badly degraded (i.e. after cremation). The utility of mitochondrial DNA sequencing in forensic casework, however, has been limited due to: (1) the fact that a single cell fairly frequently contains more than one kind of mitochondria (a situation known as "heteroplasmy"); (2) differences between mitochondrial DNA are not easily detected differences in length like those for STRs and must be

determined by comparatively costly and subjective DNA sequencing; (3) like Y-STRs, the rarity of mitochondrial sequences must be determined by empirical studies and the associated statistics are (and will remain) far less impressive than those generated with STR testing; (4) all maternally related individuals are expected to have the same mitochondrial DNA sequence(s); and (5) the ease with which samples are contaminated and cross-contaminated with mitochondrial DNA.

§ 11:32 Forensic use versus paternity case use

Even though the typing kits are often used in forensic and paternity testing, DNA is used differently in forensic cases than in paternity cases. In criminal cases, the DNA is extracted from evidentiary samples without the knowledge of whose DNA it is. The laboratory then uses statistics to determine the probability that the DNA found on a sample matches the reference sample of the suspect's or victim's DNA. This is not what is done in paternity cases. Instead, the DNA from the child is compared to the parents' DNA to determine if it is possible for either or both parents to have contributed the particular alleles present in the child. For instance, assume that a child has a 10 and an 11 allele at a particular locus and the child's mother is known to possess a 10 and a 12 allele at the same locus. The mother must have contributed the 10 allele and the 11 allele must be paternal. In this example, any man who does not possess an 11 allele could not be the child's father (barring the possibility of mutation that converts one allele to another - something that is unlikely but can be taken into consideration if needed). In the event that a man is not excluded the likelihood that a randomly chosen man might also be able to provide the same paternal alleles in the child can be determined by examining their frequency of occurrence in a relevant reference population.

Sometimes courts will confuse the two types of DNA testing. It is important to clarify this issue for judges who may be misapprehending the issues. For purposes of this chapter, when DNA testing is discussed, reference is to the testing in a forensic setting and not the testing in a paternity case.

§ 11:33 [Reserved]

§ 11:34 [Reserved]

§ 11:35 DNA Statistics

Evidence of a DNA "match" between two samples is impossible to understand and interpret without knowing the probability that a match would be declared if the samples are from different individuals. A match based on the fact that both the suspect's blood and blood at the crime scene contain hemoglobin, for example, would be meaningless because all blood contains hemoglobin. A "match" provides useful evidence of identity only to the extent that different people are unlikely to match. Thus, the question for statisticians is to determine whether the match is as common as a Chevy or as rare as a still-running Edsel. Many commentators consider the ability to quantify the probability of a "match" between samples from different people to be crucial to the admissibility of DNA-derived evidence: "without being informed of such background statistics, the jury is left to its own speculations."¹

When DNA evidence is offered in the courtroom, it is usu-

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¹McCormick, Evidence, 655 (Cleary ed.). Appellate courts in most jurisdictions have required that DNA evidence be accompanied by appropriate statistics as a condition of admissibility, see, e.g., *People v. Barney*, 8 Cal. App. 4th 798, 10 Cal. Rptr. 2d 731, 742 (1st Dist. 1992) ("The statistical calculation step is the pivotal element of DNA analysis, for the evidence means nothing without a determination of the statistical significance of a match of DNA patterns."); *People v. Axell*, 235 Cal. App. 3d 836, 866, 1 Cal. Rptr. 2d 411, 430 (2d Dist. 1991) ("We find that...a match between two DNA samples means little without data on probability..."); *People v. Wallace*, 14 Cal. App. 4th 651, 17 Cal. Rptr. 2d 721, n. 3 (1st Dist. 1993) (without valid statistics DNA evidence is "meaningless"); *Com. v. Curnin*, 409 Mass. 218, 565 N.E.2d 440 (1991) ("It is apparent from the basis on which we decide the DNA testing issue that we would not permit the admission of test results showing a DNA match (a positive result) without telling the jury anything about the likelihood of that match occurring"); *Ex parte Perry*, 586 So. 2d 242, 254 (Ala. 1991); *State v. Cauthron*, 120 Wash. 2d 879, 846 P.2d 502 (1993) ("[t]estimony of a match in DNA samples, without the statistical background or probability estimates, is neither based on a generally accepted scientific theory nor helpful to the trier of fact."); *Nelson v. State*, 628 A.2d 69, 76 (Del. 1993) (trial court's exclusion of match frequency "inherently inconsistent" with its admission of testimony of a match, because "without the necessary statistical calculations, the evidence of the match was 'meaningless' to the jury."); *State v. Brown*, 470 N.W.2d 30 (Iowa 1991) ("Without statistical evidence, the ultimate results of DNA testing would become a

ally accompanied by an estimate of the *frequency* of the matching DNA profile in a reference population. The frequency is assumed to represent the probability of a *coincidental match* between a given individual and another member of the same population. Suppose, for example, that a "match" was declared between a suspect's DNA profile and the profile of a rapist's semen. If the matching profile is found in only one person in a million, then the probability that an innocent suspect would, by coincidence, happen to match the rapist was assumed to be one in a million. Courts in most jurisdictions refused to admit DNA evidence unless it was accompanied by frequency estimates, and much of the controversy surrounding the admissibility of DNA evidence has concerned the scientific validity of the methods used to estimate DNA profile frequencies.

Of course, frequency statistics do not tell the whole story. When assessing the value of DNA evidence for proving two samples have a common source, the trier-of-fact must consider the reliability of the test as well. A DNA "match" between different individuals can occur in two ways: there may be a *coincidental match* between two people who happen to have the same genotypes, or there may be a *false positive*--that is, a false match due to an error in collecting, handling, processing or typing the samples. The potential for false positives can greatly reduce the probative value of DNA evidence.² However, courts have not required forensic experts to present estimates of the false positive rate of laboratories--perhaps because these error rates are difficult to estimate.

If no match has been declared between a reference and evidentiary sample, then the inquiry ends there. Exclusions in DNA testing require no statistical probabilities. They are considered absolute.

§ 11:36 DNA Statistics—Calculating Frequency Statistics

Forensic laboratories generally provide estimates of the frequency of a matching DNA profiles among members of

matter of speculation."); State v. Vandebogart, 136 N.H. 365, 616 A.2d 483, 494 (1992) ("A match is virtually meaningless without a statistical probability expressing the frequency with which a match would occur.").

²See, Thompson, Taroni & Aitken, How the Probability of a False Positive Affects the Value of DNA Evidence, 48 J. Forensic Sci. 47 (2003).

three broad racial groups in North America: Caucasians, African-Americans, and Hispanics.¹ The frequency estimates are derived from databases in which are recorded the DNA profiles of a large number of individuals (usually several hundred) from each racial group. The individuals profiled in the databases are usually "convenience samples" of blood donors or paternity case litigants.

To generate frequency estimates that may be as rare as one in a billion, or even one in a trillion, from a database of several hundred individuals, forensic laboratories typically follow a three-step procedure. First, they estimate the frequency of each allele in the DNA profile by simply counting to determine the proportion of people in the database who have it. If two percent of the alleles (of a particular locus) are type A and three percent are type B, their frequencies would be stated as .02 and .03 respectively.

Second, they estimate the frequency of each genotype by using the formula $2pq$, where p and q are the frequencies of the two alleles in the genotype. Suppose, for example, that a genotype consisted of alleles A and B. The frequency of genotype AB would be estimated to be $2 \times .02 \times .03 = .0012$ (approximately 1 in 833).² This formula assumes that the frequencies of the two alleles in a genotype are statistically independent and may significantly underestimate the frequency of genotypes if the allele frequencies are not independent.³

Third, they estimate the frequency of the overall DNA profile by multiplying the frequencies of each genotype. For example, suppose that there is a three-locus match between

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¹Some laboratories divide Hispanics into subcategories (Southwestern and Southeastern Hispanics) and some include additional groups (e.g., Orientals, American Indians).

²The product of the individual allele frequencies is multiplied by 2 because there are two ways a person can get a given genotype. A person may have genotype AB as a result of receiving A from his father and B from his mother, or vice versa. By analogy, there are two ways to roll number eleven with a pair of dice: a five on the first die and a six on the second, or vice-versa. Hence, the probability of rolling eleven is $2 \times 1/6 \times 1/6 = 1/18$.

³When alleles at any genotype are statistically independent in a particular population, the population is said to be in Hardy-Weinberg equilibrium. See NRC Report, p. 78.

the suspect and the evidentiary sample. At the first locus, both have genotype AB, which has an estimated frequency of 0.0012; at the second locus, both have genotype CD, which has an estimated frequency of 0.005; at the third locus both have genotype EF, which has an estimated frequency of 0.01. An analyst would typically report that the frequency of the overall profile, across the three loci, is $0.0012 \times 0.005 \times 0.01 = .00000006$, or one in 16.7 million. This formula, sometimes called the product rule, assumes that the frequencies of the genotypes are statistically independent and may significantly underestimate the frequency of the multi-locus genotype if the frequencies are not independent.⁴

§ 11:37 DNA Statistics—Concerns About Population Structure

The assumption that the alleles in DNA profiles are statistically independent has been a key point of contention. When DNA evidence was first introduced, a number of experts raised the concern that human populations might be structured, such that certain DNA profiles are particularly common in people of the same ethnic, religious or geographic subgroup. If there is a significant amount of structure in U.S. populations, then the standard method of calculating DNA profile frequencies, which assumes alleles are statistically independent, would be invalid and might greatly underestimate the frequency of a matching profile.

By analogy, suppose that a population survey showed that 10 percent (1 in 10) of Europeans have blond hair, 10 percent have blue eyes, and 10 percent have fair skin. Multiplying these frequencies yields a figure of .001 (1 in 1000) for the frequency of Europeans with all three traits. This estimate is invalid because these traits tend to occur together among Nordics. The estimate of .001 is obviously far too low for Scandinavia, where Nordics are concentrated. Moreover, because Nordics constitute a significant percentage of the

⁴When the genotypes at different loci are statistically independent in a given population, the population is said to be in linkage equilibrium. See NRC Report, p. 78-79.

European population, the estimate of .001 is also too low for Europe as a whole.¹

Whether there is sufficient structure in human populations to invalidate forensic statistics was a hotly debated issue in the early 1990s,² although empirical research has since allayed much of the concern. In the early 1990s, this debate led courts in several jurisdictions to exclude DNA evidence under the *Frye* standard, on grounds that the method for statistical computation was not generally accepted.³ A second National Research Council report in 1996 (commonly referred to as NRC II) indicated that the population substructure controversy had subsided and recommended that an alternative corrective factor often referred to as "theta" be applied in product rule calculations for only those loci where an individual possesses two copies of the same allele. "The abundance of data in different ethnic groups within the major races and the genetically and statistically sound methods recommended in this report imply that the ceiling principle and the interim ceiling principle are unnecessary."⁴ Most laboratories today follow the NRC recommendations.

One of the most recent statements of acceptance of the

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¹Any errors caused by population structure are exacerbated when the frequency of individual characteristics is estimated from an inappropriate database. For example, if one relied on a population of Sicilians to estimate the frequency of blond hair, blue eyes and fair skin, among Europeans, one might mistakenly assume each characteristic was found in one person in 100, rather than 1 in 10. Multiplication would then lead to an estimate that only 1 person in one million has blond hair, blue eyes, and fair skin.

²For reviews, see K. Roeder, DNA Fingerprinting: A Review of the Controversy, 9 *Statist. Sci.* 222 (1994), and accompanying commentary by multiple authors; B. Weir, Population Genetics in the Forensic DNA Debate, 89 *Proc. Natl. Acad. Sci.* 11654 (1992); D. Kaye, DNA Evidence: Probability, Population Genetics, and the Courts, 7 *Harv. J. L. & Tech.* 101 (1993); Thompson, 48 *J. Forensic Sci.* at 61-89.

³*Com. v. Curnin*, 409 Mass. 218, 565 N.E.2d 440 (1991); *Com. v. Lanigan*, 413 Mass. 154, 596 N.E.2d 311 (1992); *People v. Barney*, 8 Cal. App. 4th 798, 10 Cal. Rptr. 2d 731 (1st Dist. 1992); *State v. Vandebogart*, 136 N.H. 365, 616 A.2d 483 (1992); *U.S. v. Porter*, 618 A.2d 629 (D.C. 1992); *People v. Wallace*, 14 Cal. App. 4th 651, 17 Cal. Rptr. 2d 721 (1st Dist. 1993); *State v. Bible*, 175 Ariz. 549, 858 P.2d 1152 (1993).

⁴National Research Council, Committee on DNA Forensic Science: An Update, the Evaluation of Forensic DNA Evidence (1996).

unmodified product rule was made by the Supreme Court of California, a court that has rigorously examined DNA evidence.⁵ In *People v. Soto*,⁶ the court concluded that "the [courts below] correctly determined that the unmodified product rule, as applied in DNA forensic analysis, is generally accepted in the relevant scientific community of population geneticists, and that statistical calculations made utilizing that rule meet the *Kelly* standard of admissibility."⁷

§ 11:38 DNA Statistics—Error Rate Statistics

Although the validity of frequency statistics has been the primary focus of the debate over forensic DNA evidence, some commentators have argued that having valid estimates of the rate of laboratory error is at least as important as having valid frequency estimates. Frequency statistics speak to the probability of a *coincidental match*, which is only one of the ways a "match" might occur between samples from different individuals. Another way is a *false positive* due to error in the collection, handling, processing or typing of samples. For example, DNA from one sample may inadvertently be mixed with another sample, causing the same profile to appear in both, or a laboratory analyst might mistakenly declare a match by misinterpreting an ambiguous test result.¹ To evaluate DNA evidence, the trier-of-fact needs to know the overall probability of a false match (which includes the probability of a false positive), not just the probability of a coincidental match.²

When DNA evidence was first introduced, promoters of the

⁵See, e.g., *People v. Venegas*, 18 Cal. 4th 47, 74 Cal. Rptr. 2d 262, 954 P.2d 525 (1998) (recognizing the general scientific acceptance of RFLP).

⁶*People v. Soto*, 21 Cal. 4th 512, 88 Cal. Rptr. 2d 34, 981 P.2d 958 (1999).

⁷981 P.2d at 960. For a more complete understanding of the contents and recommendations of the Report, a copy of the Executive Summary can be reviewed online at <http://www.nap.edu/readingroom/books/DNA> and can be ordered from the National Academy of Science.

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¹See Thompson, 96 *Genetica* 153, for examples of the sort of ambiguous test results that might be misinterpreted, causing false positives, and a discussion of how subjectivity in interpreting DNA tests is conducive to such results.

²The probability that a match would be declared if the samples are from different people is approximately (although not precisely) the sum of

new tests often claimed that false positives are impossible.³ Professor Jonathan Koehler has suggested that test promoters "engaged in a sinister semantic game" in which they were able to issue misleading denials of the possibility that a DNA *test* could make an "error" by excluding consideration of human error in *administering* or *interpreting* the test.⁴ Needless to say, the effort to distinguish "human error" from "test error" is pointless and misleading when humans are necessarily involved in administration and interpretation of the test and it is necessary to know the overall rate of error (from whatever cause) to evaluate the test results. "For juries it is of little significance what causes an innocent person to match, what matters is how often such matches might be

the probability of a false positive and the probability of a coincidental match. Let S designate that two samples have the same source and NS that they do not; M designates that two samples have matching DNA profiles and NM that they do not; and D designates that a match is declared by a DNA analyst following testing. The overall probability of a false match being called, $p(D/NS)$, is not simply the sum of the probability of a coincidental match, $p(M/NS)$, and the probability of a false positive, $p(D/NM)$. Rather, $p(D/NS) = p(D/M)p(M/NS) + p(D/NM)p(NM/NS)$. Because $p(D/M)$ and $p(NM/NS)$ will usually be close to one, however, the sum of the probability of a coincidental match and a false positive is a close approximation to the probability of a false match.

³See, *People v. Shi Fu Huang*, 145 Misc. 2d 513, 546 N.Y.S.2d 920 (County Ct. 1989) ("Dr. Baird testified that it is impossible to get a false positive"); *People v. Wesley*, 140 Misc. 2d 306, 533 N.Y.S.2d 643 (County Ct. 1988), *aff'd*, 183 A.D.2d 75, 589 N.Y.S.2d 197 (3d Dep't 1992), appeal granted, 81 N.Y.2d 978, 598 N.Y.S.2d 779, 615 N.E.2d 236 (1993) and order *aff'd*, 83 N.Y.2d 417, 611 N.Y.S.2d 97, 633 N.E.2d 451 (1994) ("[I]t is impossible under the scientific principles, technology and procedures of DNA Fingerprinting (outside of an identical twin), to get a 'false positive' -- i.e., to identify the wrong individual as the contributor of the DNA being tested.... Under the undisputed testimony received at the hearing, no 'wrong' person, within the established powers of identity for the test, can be identified...."); *Hicks v. State*, 860 S.W.2d 419 (Tex. Crim. App. 1993) ("According to Caskey, a false positive finding was impossible..."); *Cobey v. State*, 80 Md. App. 31, 559 A.2d 391, 392 (1989) ("[A]n incorrect match is an impossible result"); see also Jonathan J. Koehler, *DNA Matches and Statistics: Important Questions, Surprising Answers*, 76 *Judicature* 222 (1993); Jonathan Koehler, *Error and Exaggeration in the Presentation of DNA Evidence at Trial*, 34 *Jurimetrics* 21 (1993) (quoting a number of similar statements from transcripts of expert testimony).

⁴Koehler, 34 *Jurimetrics* at 24.

expected."⁵

The potential for false positives in DNA testing is now broadly recognized,⁶ although the rate at which they occur is difficult to estimate due to the paucity of research on the issue. The limited research to date, however, suggests that false positives may be far more common than coincidental matches (at least for multi-locus RFLP tests).⁷ Some commentators have argued that the probability of a false positive is so much greater than the probability of a coincidental match that frequency statistics have little bearing on the value of DNA evidence.⁸ Indeed, several commentators have

⁵Laurence Mueller, *The Use of DNA Typing in Forensic Science*, 3 *Accountability in Research* 55, 56 (1993); see also William C. Thompson, *Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the "DNA War"*, 84 *J. Crim. L. & Criminology* 22, 92 (1993).

⁶"Laboratory errors happen, even in the best laboratories and even when the analyst is certain that every precaution against error was taken." NRC Report, p. 88-89; Donald Berry, Comment, 9 *Stat. Sci.* 252, 253 (1994) ("Only the frequency and type of errors are at issue."); R.C. Lewontin, Comment: *The Use of DNA Profiles in Forensic Contexts*, 9 *Stat. Sci.* 259 (1994) (discussing sources of error); William C. Thompson, Comment, 9 *Stat. Sci.* 263, 265 (1994) (discussing data on laboratory error); cf. Dan L. Burk, *DNA Identification: Possibilities and Pitfalls Revisited*, 31 *Jurimetrics* 53, 80 ("Bald statements or broad hints that DNA testing is infallible...are not only irresponsible, they border on scientific fraud").

⁷See Koehler, 76 *Judicature* at 229 ("[B]ased on the little evidence available to date, a reasonable estimate of the false positive error rate is 1-4 percent."); Koehler, 34 *Jurimetrics* at 26 (proficiency testing shows error rate of 1-4 %).

⁸Paul J. Hagerman, *DNA Typing in the Forensic Arena*, 47 *Am.J.Hum.Genet.* 876 (high false positive rate makes probability of coincidental match irrelevant); Richard Lempert, *Some Caveats Concerning DNA As Criminal Identification Evidence: With Thanks to the Reverend Bayes*, 13 *Cardozo L.Rev* 303, 325 (the probability of a coincidental match between people who have the same DNA profile "is usually dwarfed by the probability of a false positive error"); Mueller, 3 *Accountability in Research* at 58 (exact probability of a coincidental match "should hardly matter" to jury given much greater likelihood of false positive).

For example, if the probability of a false match due to laboratory error were .01 (one chance in 100) and the frequency of the profile were .000000001 (one in one billion), then the overall probability of a match between samples from different people would be approximately .010000001, a number that rounds off to .01 (one in 100). If the frequency were instead .001 (one in 1000), then the overall probability

gone so far as to suggest that jurors be told only the false positive rate⁹ to avoid the risk that they will be confused or unduly swayed by an impressive frequency (e.g., one in one million) that has little meaning or value relative to the false positive rate.¹⁰

In 1992 a report of the National Research Council (NRC I) called for more extensive proficiency testing, declaring that "laboratory error rates must be continually estimated in blind proficiency testing and must be disclosed to juries" (1). The NRC called for external, blind proficiency tests "that are truly representative of case materials (with respect to sample quality, accompanying description, etc.)". Thereafter, the Federal DNA Identification Act of 1994 required the director of the National Institute of Justice (NIJ) to report to Congress on the feasibility of establishing an external blind

of a match would be approximately .011, a number that still rounds off to .01 (one in 100). In other words, when the false positive rate is one in 100, the value of the DNA evidence is about the same whether the frequency of the matching profile is one in a thousand or one in a billion.

This example shows that having accurate statistics on the probability of a false positive may be far more important than having accurate statistics on the probability of a coincidental match if, as some experts have suggested, false positives are more common than coincidental matches.

⁹"The rate of false positives defines a practical lower bound on the probability of a match, and probability estimates based on population data that are smaller than the false-positive rate should be disregarded." R.C. Lewontin & Daniel Hartl, *Population Genetics in Forensic DNA Typing*, 254 *Science* 1745, 1749 (1991).

Professor Paul Hagerman has suggested that the frequency and false positive rate be combined into a single number by adding them together. Hagerman, *DNA Typing in the Forensic Arena*, 47 *Am.J. Hum. Genet.* 876 (1990). Where the frequency is much smaller than the probability of a false positive, the effect of this suggestion is nearly the same as simply presenting the false positive.

¹⁰Professor Richard Lempert specifically cites the danger of confusion and prejudice as a reason for presenting only the error rate statistic in cases where the probability of a false positive greatly exceeds the probability of a coincidental match....jurors provided with a laboratory's false positive rate and with information about the likelihood, assuming no testing error, of a match if the evidence DNA was not the defendant's, are likely to be hopelessly confused about the weight to accord the testimony because ordinary people are not very good at working with conditional probabilities. Thus, jurors ordinarily should receive only the laboratory's false positive rate as an estimate of the likelihood that the evidence DNA did not come from the defendant. Lempert, 13 *Cardozo L.Rev.* at 325.

proficiency testing program for DNA laboratories. But the move toward external blind proficiency testing lost momentum when the NIJ director raised a number of practical concerns. It was dealt another blow by the 1996 report of the National Research Council, which downplayed the need for proficiency testing. The 1996 NRC report suggested that the problem of laboratory error be addressed through a variety of means, and concluded that the best way to safeguard against error is to allow re-testing of samples.

§ 11:39 DNA Statistics—The "uniqueness" of DNA profiles

When the estimated frequency of the shared profile is very low, some labs will simply state "to a scientific certainty" that the samples sharing that profile *are* from the same person. For example, the FBI laboratory will claim two samples are from the same person if the estimated frequency of the shared profile among unrelated individuals is below one in 260 billion. Other labs use different cut off values for making identity claims. All of the cut-off values are arbitrary: there is no scientific reason for setting the cut off at any particular level just as scientists have not arrived at any formally recognized way of being "scientifically certain" about anything (in fact, many would argue that it is essential for scientists to be uncertain about essentially everything). Moreover, these identity claims can be misleading because they imply that there could be no alternative explanation for the "match," such as laboratory error, and they ignore the fact that close relatives are far more likely to have matching profiles than unrelated individuals. They can also be misleading in that the DNA tests themselves are powerless to provide any insight into the circumstances under which the sample was deposited and are generally unable to determine the type of tissue that was involved.

§ 11:40 DNA Statistics—Probabilities of exclusion from mixed samples

As described earlier, the interpretation of DNA profiles obtained from mixtures is difficult at best. One especially dangerous warning sign is that many testing laboratories decline to draw conclusions regarding mixed samples in the absence of knowledge regarding the DNA profiles of individu-

als that are expected by investigators to be a contributor to a sample. The relevant question for mixed samples is "What fraction of the general population would be definitively excluded as being a possible contributor to this evidentiary sample?" It is possible to objectively address the possibility that alleles are masked by the presence of either alleles from other contributors or by technical artifacts (such as stutter peaks). Such approaches typically generate fairly unimpressive numbers - particularly when the discretion to dismiss a small number of "anomalous" results are taken into account as well. As a result, it is common (though not generally acceptable to the scientific community) for analysts to report the answer to a very different question, namely "What is the rarity of the reference sample in the general population?"

§ 11:41 DNA Statistics—Cold hit statistics

Until recently, the DNA profiles that have been generated for forensic purposes have been almost exclusively those that could be characterized as "probable cause matches," in which DNA testing has been performed upon a reference sample taken from a suspect that has already been linked to a crime by direct or circumstantial evidence. A new category of DNA profile "matches" are becoming increasingly common however - those that are generated as a result of "cold hits" that result from the trawling of a large number of DNA profiles maintained in databases (usually those of previously convicted offenders). Since the primary difference between these kinds of matches is the manner in which a suspect is first identified, it is generally accepted that it is not possible to convert one type of case into the other (for instance, by simply retesting a reference sample once a "cold hit" has been identified). It is also generally accepted in the scientific community that the statistical significance of those two kinds of DNA profile matches should be determined differently. However, there are at least three different commonly held opinions on how the statistics associated with "cold hits" should be generated and presented.

The first group to address this issue was a body of experts appointed to the Committee on DNA Science by the National Research Council in 1992. The position of this group is that database searches should be used to identify potential suspects but not to calculate frequency estimates. When successful, suspects identified by these searches would then be

tested at a completely different group of independent genetic markers that would also be compared to the evidence. If these additional genetic loci also match between the suspect and evidence sample, they alone would be used to compute probabilities that reflect the significance of a match. With this methodology the genetic markers used in the original database search are specifically and deliberately excluded from any statistical calculation.

A second committee of prominent experts advocated a significantly different approach in 1996. They specifically recommended that, "When the suspect is found by a search of DNA databases, the random-match probability should be multiplied by N , the number of persons in the database."¹ Proponents of this approach feel that the first method is too conservative. Their alternative method differs in three ways: (1) no testing is performed at additional loci; (2) genetic markers used in the original database search are included in the statistical calculations; and (3) the size of the database being searched (N) is taken into consideration.

A third group is comprised of individual scientists who have published peer-reviewed manuscripts in which they argue that a "cold hit" should actually be given more weight than a match found in a "probable cause" case. Their position is based on the thinking that not only has the defendant been found to match the evidence, but many more individuals have been found to not match. In "probable cause" cases where only a single match is found during the course of DNA testing, there is at least still a formal possibility that one or more untested people may also match the evidence - that possibility becomes increasingly less likely as the database used for a cold hit becomes larger. Proponents of this approach also feel that the first method is too conservative. Their method differs from it in three ways: (1) no testing is performed at additional loci; (2) genetic markers used in the original database search are included in the statistical calculations; and (3) the size of the database being searched (N) is taken into consideration. It also differs from the second in one very important way: the effect of the database size on the significance of a match is precisely opposite - large

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¹The Evaluation of Forensic DNA Evidence, National Research Council Press, p. 40, 161 (1996).

databases generate the most damning statistics for a defendant while, in the second approach, the larger the database the less damning the statistics become to a defendant. The second and third approaches are diametrically opposed with respect to implications of the size of the database that is searched.

The proponents of each of these three approaches include many eminent scholars in the field of genetics and statistics. For instance, the blue ribbon panel of experts that generated the first National Research Council on DNA typing report (which supports the first approach as described above) includes Drs. Mary-Claire King, Richard Lempert, Eric Lander, Ruth Macklin, Thomas Marr, Victor McKusick, Philip Reilly and Sandy Zabel. Members of the second National Research Council on DNA Typing (which recommends the second approach as described above) include prominent population geneticists and statisticians such as Drs. James Crow, Arno Motulsky, Thomas Nagylaki, Mashotshi Nei, David Siegmund and Stephen Stigler. The third approach (described above) is one that has been principally advocated by very influential and often cited geneticists and statisticians such as Drs. David Balding, Peter Donnelly and Bruce Weir (as in publications such as: *Errors and Misunderstandings in the Second NRC Report*, D. J. Balding, *Jurimetrics*, Summer 1997, 37:469-476; *Evaluating DNA Profile Evidence When the Suspect Is Identified through a Database Search*, D. J. Balding and P. Donnelly, *Journal of Forensic Science*, 1996, 41:603-607; and *Interpreting DNA Evidence*, I. W. Evett and B. S. Weir, Sinauer Press, 1998, pp. 219-222). This appears to represent a genuine split between three fundamentally different approaches by experts who are significant both in number and in eminence within their fields.

§ 11:42 Laboratory Errors

Promoters of forensic DNA testing have done a good job selling the public, and even many criminal defense lawyers, on the idea that DNA tests provide a unique and infallible identification. DNA evidence has sent tens of thousands of people to prison and, in recent years, has played a vital role in exonerating men who were falsely convicted. Even former critics of DNA testing, like Barry Scheck, are widely quoted attesting to the reliability of the DNA evidence in their cases. It is easy to assume that any past problems with DNA evi-

dence have been worked out and that the tests are now unassailable.

The problem with this assumption is that it ignores case-to-case variations in the nature and quality of DNA evidence. Although DNA technology has dramatically improved since it was first used just 15 years ago, and the tests have the *potential* to produce powerful and convincing results, that potential is not realized in every case. Even when the reliability and admissibility of the underlying test is well established, there is no guarantee that a test will produce reliable results each time it is used. Case-specific issues and problems often greatly affect the quality and relevance of DNA test results. In those situations, DNA evidence is far less probative than it might initially appear.

When DNA evidence was first introduced, a number of experts testified that false positives are impossible in DNA testing.¹ This claim is now broadly recognized as wrong in principle² and it has repeatedly proven wrong in practice.³ But it has been mentioned frequently, without skepticism, in appellate court opinions.⁴

Why did experts offer this questionable testimony? One commentator has suggested that avid proponents of DNA evidence sought to allay judicial concerns about the potential for error by engaging in "a sinister semantic game".⁵ They were able to deny that a DNA test could produce an error by excluding consideration of human error in administering or interpreting the test. Sinister or not, it is misleading to exclude considerations of human error in DNA testing when

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¹See, William C. Thompson, "Forensic DNA Evidence" in Expert Evidence: A Practitioner's Guide to Law, Science and the FJC Manual 195-266 (1997); Koehler, 34 Jurimetrics at 21-39.

²See, National Research Council, DNA Technology in Forensic Science (1992); Kaye, 7 Harv. J. L & Tech at 101-72; Randolph N. Jonakait, Stories, Forensic Science and Improved Verdicts, 13 Cardozo L. Rev. 343 (1991); Koehler, 76 Judicature at 222-29; William C. Thompson, Comment on Roeder K., DNA Fingerprinting: A Review of the Controversy, 9 Stat. Sci. 263 (1994).

³See, Thompson, 96 Genetica at 153-68; Jonathan Koehler, The Random Match Probability in DNA Evidence: Irrelevant and Prejudicial?, 35 Jurimetrics 201 (1995); Thompson, 37 Jurimetrics at 405-24.

⁴See Kaye, 7 Harv. J.L & Tech 101; Thompson, 37 Jurimetrics 405.

⁵Koehler, 34 Jurimetrics 21.

humans are necessarily involved in the administration and interpretation of DNA tests. For those who must evaluate DNA evidence, it makes little difference what causes a false match, what matters is how often false matches might be expected.

False positives have occurred in proficiency tests⁶ and in actual cases.⁷ For example, the Philadelphia City Crime Laboratory recently admitted that it had accidentally switched the reference samples of the defendant and victim in a rape case. The error led the laboratory to issue a report that mistakenly stated that the defendant was a potential contributor of what the analysts took to be "seminal stains" on the victim's clothing.⁸ The report also stated that the defendant's profile was "included" in a mixed sample taken from vaginal swabs. After the sample switch came to light, the laboratory reassessed the evidence and concluded that the "seminal stains" were actually bloodstains that matched the victim's DNA profile and that the defendant was excluded as a potential contributor to the vaginal sample.⁹

In 1995, Cellmark Diagnostics made a similar error when it reported, incorrectly, that a rape defendant's DNA profile was found in what was characterized as a semen stain from a rape case. In fact, Cellmark had found the rape victim's own profile in the stain (which obviously was not semen), but had misinterpreted its own results by mixing up the defendant's and victim's profiles while recording the test results. This error was undetected when a second analyst at Cellmark reviewed the first analyst's work. It came to light only after a Cellmark witness had presented erroneous

⁶See, William C. Thompson, Ford S., "The Meaning of a Match: Sources of Ambiguity in the Interpretation of DNA Prints" in *Forensic DNA Technology* (1991); Thompson, 96 *Genetica* 153; Koehler, 76 *Judicature* 222; Thompson, 9 *Stat. Sci.* 263; Koehler, 35 *Jurimetrics* 201; Thompson, 37 *Jurimetrics* 405; Mueller, 3 *Accountability in Research* 55; Roeder, 9 *Stat. Sci.* 222.

⁷Thompson, 37 *Jurimetrics* 405; Scheck B, Neufeld P, Dwyer F., *Actual Innocence* (2000).

⁸Brenner L, Pflieger B., *Investigation of the Sexual Assault of Danah H. Philadelphia (PA): Philadelphia Police Department DNA Identification Laboratory*; 1999 Sept. 24. Lab No.: 97-70826.

⁹Brenner L, Pflieger B., *Amended Report: Investigation of the Sexual Assault of Danah H. Philadelphia (PA): Philadelphia Police Department DNA Identification Laboratory*; 2000 Feb. 7. Lab No.: 97-70826.

testimony about the false match in a pretrial hearing in the case. Cellmark issued a revised report that stated that the evidentiary sample matched the victim's own DNA profile and that the defendant was excluded as a potential donor.¹⁰

False positives can also arise due to misinterpretation of test results. One such error led to the false conviction of Timothy Durham.¹¹ In 1993 a Tulsa Oklahoma jury convicted Durham of the rape of an 11-year-old girl. He was sentenced to 3,000 years in prison. The prosecution presented three pieces of evidence against him: the young victim's eyewitness identification, testimony that Durham's hair was similar (in microscopic examination) to hair found at the crime scene, and a DNA test (DQ-alpha) that reportedly showed that Durham's genotype matched that of the semen donor. Durham presented eleven witnesses who placed him in another state at the time of the crime, but the jury rejected his alibi defense. Fortunately for Durham, post-conviction DNA testing showed that he did not share the DQ-alpha genotype found in the semen. He was also excluded at several other genetic loci in multiple tests. The initial DNA test result that helped convict Durham was proven to have been a false positive. The error arose from misinterpretation. The laboratory had failed to completely separate male from female DNA during differential extraction of the semen stain. The victim's alleles, when combined with those of the true rapist, produced an apparent genotype that matched Durham's. The laboratory mistook this mixed profile for a single source result, and thereby falsely incriminated an innocent man. Durham was released from prison in 1997.

In 2003, another DNA false positive came to light. Josiah Sutton, a 16-year-old from Houston was falsely convicted of rape in 1996 and sentenced to 25 years in prison based on a misinterpreted DNA test. The error came to light when one of the authors of this chapter was reviewing casework from the Houston Police Department DNA/Serology laboratory at

¹⁰Cotton RW, Word C., Amended Report of Laboratory Examination, Germantown (MD): Cellmark Diagnostics; 1995 Nov 20. Case No.: F951078. A transcript of testimony in this case, in which a Cellmark expert admits to the error, can be found at www.scientific.org.

¹¹Thompson, 37 *Jurimetrics* 405; Scheck, Neufeld & Dwyer, *Actual Innocence*.

the request of a Houston television station. Retesting using STRs proved conclusively that Sutton was innocent.¹²

Although experience has shown that false positives can occur, the rate at which they occur is difficult to estimate on the basis of existing data. Most laboratories participate in periodic proficiency tests, which can cast some light on the potential for error. European forensic laboratories have carried out collaborative exercises involving analysis of stains from known sources. However, this work is designed more to test the uniformity of DNA test results among laboratories using the same protocol than to determine the rate of errors. In the United States, TWGDAM guidelines call for each analyst to take two proficiency tests each year¹³ and proficiency testing is a requirement for laboratory certification under the program administered by ASCLAD-LAB.¹⁴ However, these tests generally are not well designed for estimating the rate of false positives. The tests typically are not blind (i.e., the analysts know they are being tested), they involve limited numbers of samples, and the samples may be easier to analyze than those encountered in routine casework.

It is not always possible to tell from the laboratory records whether samples *actually* were mixed up or cross-contaminated. However, careful review of the laboratory records will usually provide important information about whether such errors *could have happened*. For example, evidence that a reference sample from the defendant was handled or processed in close proximity to samples from the crime scene can support the theory that a sample handling error explains incriminating results. In one case, review of a criminalist's notes showed that the defendant's trousers, collected at his home, were transported to the laboratory in the same box that contained a number of items from the crime scene that were saturated with the victim's blood. This fact cast important new light on a seemingly incriminating

¹²Several articles about this case can be found at www.scientific.org

¹³Technical Working Group on DNA Analysis Methods (TWGDAM) established guidelines for a quality assurance program for DNA testing laboratories; including RFLP and PCR technologies. 18 Crime Lab Dig. 44 (1995).

¹⁴National Research Council, *The Evaluation of Forensic DNA Evidence* (1996).

result: blood from victim was detected on the defendant's trousers.

It is suggested that defense lawyers obtain and review complete copies of all records related to evidentiary samples collected in the case. It should be possible to document the complete history of every sample from the time it was initially collected through its ultimate disposition.

§ 11:43 Inadvertent Transfer of DNA

One of the most striking developments in forensic DNA testing in recent years is the testing of ever smaller biological samples. Whereas the original DNA tests required a fairly large amount (i.e. a blood stain the size of a dime) of biological material to get a result, current DNA tests are so sensitive that they can type the DNA found in samples containing only a few cells. There is likely to be enough of your DNA on the book you are reading right now for your DNA profile to be determined by a crime lab.

The increasing sensitivity of DNA tests has affected the nature of criminal investigations and has created a new class of DNA evidence. Analysts talk of detecting "trace DNA," such as the minute quantities of DNA transferred through skin contact. DNA typing is currently being applied, with varying degrees of success, to samples such as doorbells pressed in home invasion cases, eyeglasses found at a crime scene, handles of knives and other weapons, soda straws, and even single fingerprints.

These developments will bring more DNA evidence to court in a wider variety of cases and may well open new lines of defense. A key issue will be the potential for inadvertent transfer of small amounts of DNA from one item to another, a process that could easily incriminate an innocent person. Studies have documented the presence of typeable quantities of human DNA on doorknobs, coffee cups and other common items.¹ Studies have also documented the inadvertent

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¹See, R.A.H. van Oorschot, DNA Fingerprints from Fingerprints, *Nature*, June 19, 1997, at 767; Findlay, et al, DNA Fingerprinting from Single Cells, *Nature*, October 9, 1997, at 555-556; Ladd, et al, A Systematic Analysis of Secondary DNA Transfer, 44 *J. Forensic Sci.* 1270 (1999).

transfer of human DNA from one item to another.² *Primary transfer* occurs when DNA transferred from a person to an item. *Secondary transfer* is when the DNA deposited on one item is transferred to a second item. *Tertiary transfer* is when the DNA on the second item is, in turn, transferred to a third. There are published studies that document secondary transfer of DNA (in quantities that can be detected by STR tests) from items that people simply touched to other items.

A recent study commissioned by a wealthy defendant was used to show that tertiary transfer of DNA could have occurred in a manner that falsely incriminated the defendant. Dr. Dirk Greineder, a prominent physician and adjunct Harvard Professor, was accused of killing his wife.³ A DNA profile similar to Greineder's was found, mixed with his wife's profile, on gloves and a knife found near the crime scene. Greineder denied touching these items, which appeared to have been used by the killer. But how did his DNA get on them?

Greineder offered a two-pronged defense. First, he challenged the conclusion that his DNA matched that on the gloves, noting inconsistencies between his profile and the profile on the gloves. The crime laboratory had shifted its threshold for scoring alleles in a manner that allowed it to count alleles that matched with Greineder, while ignoring some that did not. And the lab had to evoke the theory of "allelic drop out" to explain why some of Greineder's alleles were not found.

Greineder's second line of defense is our focus here. He argued that his DNA could have gotten onto the glove

²R.A.H. van Oorschot, et al, HUMTH01 Validation Studies: Effect of Substrate Environment and Mixtures, 41 J. Forensic Sci. 142 (1996); van Oorschot, DNA Fingerprints from Fingerprints, Nature, June 19, 1997, at 767; Findlay, et al, DNA Fingerprinting from Single Cells, Nature, October 9, 1997, at 555-556; Van Hoofstat, et. al., DNA Typing of Fingerprints Using Capillary Electrophoresis: Effect of Dactyloscopic Powders, 20 Electrophoresis 2870 (1999); Szibor, et al, Efficiency of Forensic mt DNA Analysis: Case Examples Demonstrating the Identification of Traces, 113 Forensic Science International 71 (2000); A.E. Kisilevsky, et al, DNA PCR STR Profiling of Skin Cells Transferred through Handling, Abstract from the 46th Annual Meeting of the Canadian Society of Forensic Scientists (Edmonton, Alberta, November 16-21, 1999).

³Commonwealth v. Greineder (Norfolk County Superior Court, No. 108588, 2001).

through tertiary transfer. He and his wife had shared a towel the morning of the murder—perhaps his DNA was transferred from his face to the towel, and from the towel to his wife's face. His wife was later attacked by a glove-wearing stranger who struck her on the face, strangled her, and stabbed her, in the process transferring Greineder's DNA from his wife's face to the gloves and the knife. According to this theory, the tell-tale extra alleles on the gloves and knife that matched neither Greineder nor his wife were those of the killer.

To support the theory that his DNA could have been transferred innocently to the instruments of murder, Greineder commissioned a study. Forensic scientists Marc Taylor and Elizabeth Johnson, of Technical Associates (an independent laboratory in Ventura, California) simulated the sequence of events posited by the defense theory: a man wiped his face with a towel, then a woman wiped her face with the towel, then gloves and a knife like those used in the murder were rubbed against the woman's face. DNA tests on the gloves and knife revealed a mixture of DNA from the man and woman—exactly what was found in the Greineder case. Taylor was allowed to present his findings to the jury. Although the jury ultimately convicted Greineder (there was other incriminating evidence besides the DNA), the case is a good example of how the amazing sensitivity of contemporary DNA profiling methods facilitate a plausible explanation for what might at first seem to be a damning DNA test result.

III. HOW THE COURTS HAVE APPROACHED DNA TESTING

§ 11:44 Generally

By and large, the earliest cases regarding DNA testing were more accepting of the results of such testing and, before 1991, there were virtually no cases that seriously questioned either the validity of the testing or even the statistical odds that were admitted—including such astronomical odds as 30 billion to one!

There were a few reasons for the courts' early acceptance of DNA testing. First, until the critics of DNA testing became more vocal in their disapproval of the testing procedures, lay persons were unaware of the problems with the science and unable to challenge the science. Virtually no lawyers understood the science fully enough to challenge it and few, if any, knew who to contact for assistance.

Second, most defense lawyers were unaware of who the experts in the field of DNA testing were until such individuals began to publish their works. Third, the vast majority of forensic DNA work was done by private laboratories, which, citing proprietary reasons, did not make their preliminary studies and results available. The few laboratories that perform DNA testing—namely, Cellmark, Lifecodes and even the FBI—have been proprietary about their underlying data.¹ As such, it was difficult to challenge the underlying information when much of it was not being revealed to the public.

Once certain experts began to question aspects of the science, however, those experts began to testify in courts. With the publication of the populations substructure controversy in *Science* in 1991 and in the NRC study, many courts began to seriously question the validity of DNA testing as reliable forensic evidence.

The reaction in the courtroom to DNA testing has gone through a type of metamorphosis during the past few years. At first, there was widespread acceptance, which gave way to a decline in the admission of the evidence, followed by an admission of the testimony but in a more guarded fashion. Most recently, courts have once again begun to loosen the restrictions on admission of the evidence.

Not surprisingly, the way in which the jurisdictions initially considered DNA testing seems to have had a lot to do with the manner in which the state dealt with the issue of scientific admissibility. For those states that retained a more traditional *Frye* -type standard, the question of admissibility of the evidence proved to be more daunting than in those states that have supplanted the test with a newer, “relevancy” type standard. Accordingly, as part of the analysis of the various states’ approaches, the test of admissibility will be addressed where relevant.²

§ 11:45 Jurisdictions admitting DNA evidence

By now, nearly all jurisdictions have admitted DNA

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¹See generally Thompson, Lessons From the “DNA War,” at 36 and 78-79.

²For a complete discussion of the admissibility of scientific evidence, see Chapter 10 *supra*, which devotes a substantial portion to the admission of novel scientific evidence.

evidence. By and large, the cases that admitted DNA evidence without much (or any) challenge were the earliest cases. As the science developed and the critics became more involved in the science, many of the courts began seriously questioning whether DNA evidence met the *Frye* standard of admissibility.

Since the publication of the 1992 NRC Report, a number of cases have questioned the appropriateness of DNA evidence in the courtroom and a number of courts have put the admission of the evidence on hold until certain problems have been satisfactorily resolved. Following the 1996 Pre-publication Report of the NRC, finding the ceiling principle and modified ceiling principle no longer necessary, the case law has begun to change again, moving toward more complete acceptance of DNA evidence. Many jurisdictions have admitted DNA evidence, holding that the problems with DNA evidence go to the question of weight, not admissibility.

§ 11:46 Jurisdictions admitting DNA evidence—The early cases

An early case addressing DNA testimony in a forensic setting was a South Carolina case entitled *State v. Ford*.¹ In *Ford*, the victim was raped by a man wearing a Halloween mask and was subsequently unable to identify Ford as her assailant. From the sperm taken from a vaginal swab and the victim's clothing, the prosecution claimed that the sample matched the defendant's DNA.

At the time of trial, the defendant conceded that DNA extraction and the electrophoresis process had gained general scientific acceptance, but that "the process as a whole" had not. The Supreme Court of South Carolina remarked that while there were possible problems with the forensic use of DNA such as contamination of the samples, such concerns were individual concerns of individual cases and did not affect the general scientific reliability of the process. Thus, the court found that:

DNA print testing and the process of RFLP analysis have been recognized as reliable and have gained general acceptance in

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¹State v. Ford, 392 S.E.2d 781 (S.C. 1990).

the scientific community. In addition, the evidence indicated that RFLP analysis involves scientifically and professionally established techniques rather than untested methods or unproven hypotheses. Thus, the RFLP analysis and test results would be admissible under . . . the Frye standard.²

Maryland addressed the issue of DNA in an early case entitled *Cobey v. State*.³ In *Cobey*, the victim was raped and brutalized by a man who attacked her in a park and then stole her car. Upon his arrest, a DNA analysis comparing the defendant's blood to semen found on the victim's underclothing was undertaken and they were found to match.

The defense challenged primarily the methods used by the laboratory (Cellmark), but the court also addressed the admissibility of DNA analysis as a whole. Providing an encapsulated discussion of how a DNA profile is made, the court quoted a law review article for the proposition that “[c]ommercial laboratories marketing the tests say their research shows that DNA typing is as accurate as a fingerprint.”⁴

In *Cobey*, the prosecution introduced five experts to vouch for the acceptability of DNA profiling in the scientific community, while the defense presented no evidence to the contrary. Determining that the evidence was admissible, the court found that that defense challenges to the procedures of the laboratory were not persuasive, remarking that it was significant that the defendant produced no expert testimony.

However, the court did question the future admissibility of DNA evidence, stating as follows:

We make crystal clear that we are not, at this juncture, holding that DNA fingerprinting is now admissible willy-nilly in all criminal trials conducted between this date [and when the new statute takes effect]. . . We are merely holding that, based upon this record, Judge Ruben did not err in finding that DNA fingerprinting was generally acceptable in the scien-

²Id. at 784.

³*Cobey v. State*, 559 A.2d 391 (Md. App. 1989), cert. denied, 565 A.2d 670 (Md. 1989).

⁴559 A.2d at 392, quoting Moss, DNA—The New Fingerprints, 74 ABA J 66 (1988).

tific community and in permitting its introduction into evidence, since there was no evidence to the contrary.⁵

Subsequently, Maryland enacted a statute governing the admissibility of DNA evidence.⁶

In 1991, in a lengthy opinion addressing the standards of admissibility of scientific evidence,⁷ Arkansas determined in *Prater v. State*,⁸ that DNA evidence met such a standard and should be admissible. The Arkansas Supreme Court adopted a three-part “relevancy approach” which required a judge to conduct a preliminary hearing to determine: “(1) the reliability of the novel process used to generate the evidence, (2) the possibility that admitting the evidence would overwhelm, confuse or mislead the jury, and (3) the connection between the novel process evidence to be offered and the disputed factual issues in the particular case.”⁹

Under this new approach, the court first determines whether the proffered evidence is reliable, not misleading, and helpful. With DNA testing, the court found that all the prongs of the standard were met concerning the testing procedure itself. “In sum, we have no hesitancy in affirming the trial court’s ruling that DNA testing is such a sufficiently reliable scientific procedure that it may be admitted in evidence.”¹⁰

The Arkansas Supreme Court did remark, however, that challenges to the protocol used by laboratories were still available to defendants in individual cases, but that there was no error in the admission in the particular case.

Finally, the court addressed the issue of probabilities concerning the DNA match. Noting that there were concerns about the probabilities of population genetics, the court nonetheless concluded that under the relevancy standard, the probabilities should be admissible. Significant to its decision was the failure of the defense to adequately challenge the

⁵Id. at 398.

⁶See § 11:44 *infra*.

⁷For a discussion of this and other cases addressing the standards of novel scientific evidence, see Chapter 10, *supra*.

⁸*Prater v. State*, 820 S.W.2d 429 (Ark. 1991).

⁹Id. at 431, citing Weinstein & Berger, *Weinstein’s Evidence* ¶ 702[03] at 702-18 to 702-20 (1991).

¹⁰Id. at 436.

issue. The court left the door open on the issue, stating that “just because there was no meaningful attack upon the population genetics in this case does not mean that there can not be a successful attack in future cases.”¹¹

In New Jersey, the Superior Court (the intermediate appellate court) found that DNA testing of the PCR type (rather than the RFLP type) was admissible in the case of *State v. Williams*.¹² In New Jersey, the courts use a hybrid of the *Frye* admissibility test which requires as proof that a science has met the threshold of scientific acceptability in the community and that the moving party introduce sufficient evidence in the form of expert opinions, authoritative scientific and legal writings and/or judicial opinions.

The experts in the case at bar were impressive, having testified numerous times as experts and having published over 100 times each in peer review journals. The defense, the court noted “did not offer a single witness in opposition.”¹³ Thus, the court found that the prosecution had met its burden of the standard of admissibility of PCR testing of DNA. It stated:

The record contains an abundance of evidence offered by the State supporting its contention that PCR testing has gained general acceptance in the particular field in which it belongs. Its reliability has been proven pursuant to the standard [required] . . . , by the testimony of experts, by evidence of hundreds of authoritative scientific articles and other literature supporting this testing technique, and by the overwhelming acceptance of PCR testing in dozens of judicial decisions in other states throughout the nation.¹⁴

Thus, based upon the evidence presented in that case, the court ruled that the standard of admissibility for novel scientific evidence was met in this case to permit into evidence PCR testing.

The Supreme Court of Missouri in *State v. Davis*,¹⁵ determined that evidence of DNA testing was admissible, although it noted that some jurisdictions had criticized the

¹¹Id. at 439.

¹²*State v. Williams*, 599 A.2d 960 (N.J. Super. 1991).

¹³Id. at 967.

¹⁴Id.

¹⁵*State v. Davis*, 814 S.W.2d 593 (Mo. 1991), cert. denied, 502 U.S. 1047 (1992).

testing and statistical procedure employed by some of the laboratories at the time. Despite the *Davis* court's recognition of the shortcomings of certain laboratory procedures, it was convinced that DNA testing met the standard required for admissibility and that any problems with the manner of testing went to the weight of the evidence and not its admissibility. Based on that rationale, the court concluded that "[i]t is within the trial court's sound discretion to admit or exclude an expert's testimony . . . and no abuse of discretion has been demonstrated."¹⁶

The Ohio Court of Appeals determined that DNA evidence was admissible in *State v. Thomas*,¹⁷ although it did so with virtually no meaningful discussion of the challenges raised to the evidence. In this rape case, the defendant challenged the evidence on the grounds that: (1) there was no evidence that the person who testified about the DNA match was an expert qualified to render an opinion, and (2) there was no evidence to establish that DNA testing was based on a reasonable degree of scientific certainty.

The court disagreed with both allegations and found that the scientific evidence complies with the state rules of evidence governing the admission of such evidence. Quoting *State v. Williams*,¹⁸ the court stated:

[W]e refuse to engage in scientific nosecounting for the purpose of deciding whether evidence based on newly ascertained or applied scientific principles is admissible. We believe the Rules of Evidence establish adequate preconditions for admissibility of expert testimony, and we leave to the discretion of this state's judiciary, on a case by case basis, to decide whether the questioned testimony is relevant and will assist the trier of fact to understand the evidence or to determine a fact in issue.¹⁹

Ohio, a state that abandoned the *Frye* test in favor of a relevancy test, uses the catch-phrase "scientific nosecounting" as a shorthand expression for what it perceives to be wrong with the *Frye* test. Other jurisdictions, including the

¹⁶Id. at 603 (citations omitted).

¹⁷*State v. Thomas*, 579 N.E.2d 290 (Ohio App. 1991).

¹⁸*State v. Williams*, 446 N.E.2d 444 (Ohio 1983).

¹⁹579 N.E.2d at 448.

Third Circuit,²⁰ Colorado,²¹ Maine,²² and New Jersey,²³ have also referred to the *Frye* test as “nosecounting”—a concept that does not seem to be a fair interpretation of the *Frye* test.

In early 1992, the NRC issued its position on DNA testing, challenging some of the concepts that certain scientists claimed were settled principles. Despite the publication of that document, certain courts chose to ignore the dispute and continued admitting DNA evidence in a liberal fashion, generally claiming that the disputes went to the weight of the evidence, not to its admissibility.²⁴

§ 11:47 Jurisdictions admitting DNA evidence—Cases in the early to mid-1990s

In a very brief decision, the Court of Criminal Appeals of Texas upheld the admission of DNA testing in which the expert testified that the odds of DNA belonging to someone other than the defendant were one in 18 billion.¹

In a slightly more detailed opinion, that same court determined that: (1) Texas no longer used a *Frye* standard, and (2) the RFLP technique of DNA testing, along with the population frequency studies, was also valid and admissible.² In *Kelly*, the court concluded that the *Frye* general acceptance test was no longer the law in Texas, stating that there was no “textual basis in Rule 702 for a special admissibility

²⁰*Deluca v. Merrell Dow Pharms., Inc.*, 911 F.2d 941, 955 (3d Cir. 1990), overruled on other grounds, *Merrell Dow Pharms., Inc. v. Havner*, 953 S.W.2d 706 (Tex. 1997), citing *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993).

²¹*Lindsey v. People*, 892 P.2d 281, 289 (Colo. 1988).

²²*State v. Williams*, 388 A.2d 500 (Me. 1978).

²³*State v. Williams*, 599 A.2d 960, 964 (N.J. Sup. Ct. 1991).

²⁴Other decisions in the late 1980s and early 1990s also admitted DNA without much challenge: *Smith v. Deppish*, 807 P.2d 144 (Kan. 1991); *State v. Ford*, 392 S.E.2d 781 (S.C. 1990); *Glover v. State*, 787 S.W.2d 544 (Tex. App. 1990), *aff'd*, 825 S.W.2d 127 (Tex. App. 1992); and *State v. Woodall*, 385 S.E.2d 253 (W. Va. 1989).

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¹*Glover v. State*, 825 S.W.2d 127 (Tex. App. 1992).

²*Kelly v. State*, 824 S.W.2d 568 (Tex. App. 1992).

standard for novel scientific evidence.”³ Second, “as should be fairly obvious, scientific evidence may be shown reliable even though not yet generally accepted in the relevant scientific community.”⁴

The *Kelly* court also determined that the trial court did not abuse its discretion in admitting the DNA evidence. It stated:

We conclude that it was demonstrated by clear and convincing evidence that the scientific principle underlying the RFLP technique was valid, that the RFLP technique itself was valid, that the technique was properly applied in this case, and that the related population frequency studies were also valid and reliable.⁵

The Supreme Court of Ohio, in *State v. Pierce*,⁶ reaffirmed its earlier case law admitting DNA evidence. Repeatedly, the court remarked that the standard of admissibility was the relevancy test, not the *Frye* test and, therefore, a discussion of whether the science was generally accepted in the scientific community was irrelevant.

In the *Pierce* case, there were three victims who were alleged to have been raped by the defendant. At trial, the prosecutor introduced evidence that the defendant’s DNA matched specimens from the crime scene. During that trial, the prosecution’s experts claimed that the chances were “one in forty billion” that the DNA came from someone other than the defendant, over the defense’s strong challenges to such evidence.

The defense in *Pierce* informed the court about the dispute recognized in the NRC Report over statistical models, to which the court acknowledged that “[a] number of scientists and other commentators have criticized the soundness of [the statistical assumptions supporting DNA comparisons].”

³Id. at 572.

⁴Id. The court also suggested that the courts use the seven-factor Weinstein & Berger test to determine whether the evidence was “reliable.” A complete discussion of this test is contained in Chapter 10.

⁵Id. at 574.

⁶*State v. Pierce*, 597 N.E.2d 107 (Ohio 1992). But see *State v. Nemeth*, 694 N.E.2d 1332 (Ohio 1998) (remarking that *Pierce* predates the amendment to Rule 702, which now explicitly requires “that information forming the basis of the expert testimony by ‘reliable.’ ” Thus, the *Pierce* case can no longer be considered good law).

Nevertheless, the court was unswayed by the criticisms of the various scientists to whose work the report referred. “The jury was free to reject the DNA evidence if it is concluded that the trial court did not abuse its discretion in admitting the calculations as to the frequency probability, and it was for the jury to determine what weight, if any to give such evidence.”⁷

The Supreme Court of Virginia completely avoided the issues raised in the 1992 NRC Report in the case of *Satcher v. Commonwealth*.⁸ In that case, the defendant was accused of the attempted rape and robbery of one woman and the rape and the murder of another. Semen found at the scene of murder matched the DNA taken from the defendant.

The Virginia court skirted the problems outlined in the 1992 NRC Report by claiming that DNA testing had been found to be a reliable scientific technique in the earlier 1989 *Spencer* case⁹—despite the fact that in the earlier case no challenge had been made to the evidence and that in the interim the NRC Report had been issued.¹⁰ Rather, the court stated: “We reiterate our adherence to the *Spencer* rule that DNA testing is a reliable scientific technique.”¹¹ The court then found that the trial judge was correct in ruling that DNA evidence was appropriately given to the jury to consider.

The Michigan Supreme Court held in *People v. Adams*¹² that, “given the overall acceptance of the technique in other jurisdictions, we hold that trial courts may take judicial notice of the reliability of DNA identification testing.”¹³ Although the Michigan court did address the fact that the

⁷Id. at 115.

⁸*Satcher v. Commonwealth*, 421 S.E.2d 821 (Va. 1992), cert. denied, 507 U.S. 733 (1993), rev’d in part on other grounds, *Satcher v. Pruett*, 126 F.3d 561 (4th Cir. 1997).

⁹*Spencer v. Commonwealth*, 385 S.E.2d 850 (Va. 1989), cert. denied, 110 493 U.S. 1093 (1990).

¹⁰An earlier reference in the *Satcher* case concerning how DNA profiles are made cites the NRC Report, thus indicating the court’s awareness of the study.

¹¹Id. at 834.

¹²*People v. Adams*, 489 N.W.2d 192 (Mich. App. 1992), judgment modified, 441 Mich. 916 (1993).

¹³Id. at 197.

defense raised the Hardy-Weinberg equilibrium problem, it found that those contentions were inconsistent with the testimony presented in the lower court.

Additionally, the court dismissed the contentions of the defense that the admission of DNA statistical evidence would lead to “trial by mathematics,” as in the instant case, where an expert claimed that the chances of the DNA in question belonging to someone other than the defendant were one in 400 million. Noting that the statistical evidence introduced in DNA testing is independently proved, the court found that without statistics the evidence is speculative. Here, however, the jury is “free to disregard or discredit the evidence.”¹⁴

In *Polk v. State*,¹⁵ the Mississippi Court adopted a “three prong” approach similar to those suggested by a New York court¹⁶ and an Alabama court.¹⁷ The three prongs identified by the *Polk* case were:

1. Is there a theory, generally accepted in the scientific community, that supports the conclusion that DNA forensic testing can produce reliable results?
2. Are there current techniques that are capable of producing reliable results in DNA identification and that are generally accepted in the scientific community?
3. In this particular case, did the testing laboratory perform generally accepted scientific techniques without error in the performance or interpretation of the tests?

The court’s answer to each of the questions was in the affirmative. First, the court determined that there was ample evidence that the DNA testing does produce reliable results and that the trial judge’s decision in that regard was supported by ample evidence. Second, the court also found that the results of DNA testing were reliable and were generally accepted in the scientific community. Third, the court reviewed the techniques used by the laboratory in question and determined that they were acceptable. The defendant’s

¹⁴Id. at 198.

¹⁵*Polk v. State*, 612 So. 2d 381 (Miss. 1992).

¹⁶*People v. Castro*, 545 N.Y.S.2d 985 (Sup. Ct. 1989). But see *People v. Mohit*, 579 N.Y.S.2d 990 (N.Y. Ct. 1992).

¹⁷*Ex parte Perry v. State*, 586 So. 2d 242 (Ala. 1991).

challenge to such technique was that their own expert was unable to duplicate the measurements. The court, however, found that such a challenge was no more than an attack on the credibility of the evidence, not its competency as a matter of law.

Significantly, the court in this case issued guidelines to be followed when a case involved DNA evidence. Those guidelines, set forth as the appendix to the case, provide that the laboratory must follow strict quality control guidelines throughout the entire procedure. The court focused on the areas where the DNA testing could be contaminated and emphasized that the procedures must be documented. In the event you have a case in Mississippi, make sure to be familiar not only with the case, but with the guidelines as well.

In 1993, Oregon, North Carolina and Wyoming all jumped on the bandwagon admitting DNA evidence. Oregon, unlike most jurisdictions, has addressed both RFLP DNA evidence as well as PCR evidence. In *State v. Futch*,¹⁸ the Oregon Court of Appeals, citing the *Daubert* case, found RFLP evidence admissible. *Futch* is a classic example of where a *Frye*-type analysis would preclude the admission of the evidence, a less stringent analysis would permit such admission.¹⁹ In *Futch*, the defense experts claimed both that the match between the crime scene and the known sample was in error and that the database used by the laboratory was scientifically unacceptable. The court described the scientific debate in the following terms:

The record is a classic example of a “battle of the experts,” a phenomena not uncommon to all trials in which scientific evidence is admitted into evidence. There was expert testimony presented in both the state’s and defendant’s cases-in-chief, as well as on rebuttal and surrebuttal, on the validity of the testing process used in this case. Each point made was the subject of a counterpoint explaining why the point was not valid, which in turn was countered by more scientific opinion.²⁰

These problems, nevertheless, were rather glossed over by

¹⁸*State v. Futch*, 860 P.2d 264 (Or. App. 1993), *aff’d*, 924 P.2d 832 (Or. 1996).

¹⁹Oregon employs a multifactor test that has also been held to be “consistent with” the *Daubert* approach. See 860 P.2d at 268-70; *State v. Brown*, 687 P.2d 751 (Or. 1984).

²⁰860 P. 2d at 271.

the courts, who permitted the evidence to come in and let the jury sort it out. The conclusion of the court after addressing the facts of the specific allegations was as follows:

In the light of this record, we cannot say that the state's evidence, concerning the testing procedures used in this case, was so lacking that it had no weight whatsoever. Although reasonable factfinders might differ as to whether the tests performed were accurate, it would be improper for us to preempt the jury's determination of the issue on this record.²¹

The court likewise dismissed the contentions of the defense concerning the statistical analysis problems, stating "[e]ven if the defendant's experts are correct in their assessment of the statistical probability involved, that probability is sufficient to make the question of a 'match' a jury issue."²²

In *State v. Lyons*,²³ the Court of Appeals of Oregon also determined that PCR evidence met the requirements for admissibility. *Lyons* involved a particularly gruesome rape and murder of a woman. According to the expert for the prosecution, the gene type taken from specimens at the crime scene (and which were not from the victim) were the same gene type as those of the defendant and were found in two to three percent of the Caucasian population.

After a detailed discussion of the PCR method of analysis as well as the seven-factor relevancy test for admissibility,²⁴ the court concluded that the evidence should be admissible. It held that the PCR method was relevant and helpful to the jury. In addition, the probative evidence outweighed any possible prejudice. The court stated:

[W]e find nothing about the PCR method that would undeniably cause jurors to misuse, misinterpret or overvalue the results. Unlike the RFLP method at issue in *Futch* the results of the PCR method are not expressed in terms of statistical probabilities capable of creating the aura of absolute identification. Instead, the results are expressed as a conclusion that the identified gene type common to the sample and the defendant is one found in a certain percentage of a population group. We conclude that the probative value of PCR

²¹Id. at 272.

²²Id. at 273.

²³*State v. Lyons*, 863 P.2d 1303 (1993), aff'd, 324 Or. 256, 924 P.2d 802 (1996).

²⁴Oregon's seven-factor relevancy test is addressed in Chapter 10.

method DNA evidence is not outweighed by [unfair prejudice and other dangers] . . .²⁵

The Court of Appeals of North Carolina held that the RFLP type of DNA testimony was admissible in the case of *State v. Futrell*.²⁶ In *Futrell*, the defendant introduced expert evidence that was critical of the FBI's statistical methodology, specifically challenging the size of the database that the FBI used. Additionally, the defense raised the Hardy-Weinberg Equilibrium problem.

The court dismissed these claims, citing to an early 1990 case, *State v. Pennington*,²⁷ where the Supreme Court of North Carolina had admitted DNA evidence, albeit stating that issues pertaining to relevancy or prejudice could still be raised. For example, if the defendant in another case was able to establish contamination or other problems, the issues could be introduced relevant to the issue of the weight of the evidence. In the event the defendant could establish that the evidence was so tainted as to be totally unreliable, then it could be excluded.

However, citing a later case than *Pennington*,²⁸ the court of appeals in *Futrell* found that any challenges that did not pertain to relevancy or prejudice were matters for the jury and not the court. Quoting *Bruno*, the court in *Futrell* stated:

[W]here unfair prejudice is not clear and where there is merely conflicting evidence or where two experts have reached differing results based on independent analyses of the DNA, the issue becomes one of credibility of the experts. In that situation the jury is obligated to determine what weight each expert's testimony should receive.²⁹

In the *Futrell* case, the court found that while the evidence was conflicting on the technical matters raised, it was for the jury to determine what weight to give the evidence and the allegation of "unfair prejudice"³⁰ was not established by the defendant.

²⁵863 P.2d at 1311.

²⁶*State v. Futrell*, 436 S.E.2d 884 (N.C. App. 1993).

²⁷*State v. Pennington*, 393 S.E.2d 847 (N.C. 1990).

²⁸*State v. Bruno*, 424 S.E.2d 440 (N.C. App. 1993), appeal dismissed, 428 S.E.2d 185 (N.C. 1993).

²⁹436 S.E.2d at 889.

³⁰Establishing "unfair prejudice" would take the issue from the jury ac-

The Supreme Court of Wyoming upheld the admission of RFLP analysis in DNA testing in the very interesting case of *Springfield v. State*.³¹ *Springfield* presents a unique circumstance which brings into focus the exact nature of the population substructure problem. In this case, the defendant was three-fourths Crow Native American and one-fourth Black. The DNA profile was compared to databases of Black, Caucasian, Hispanic and Native American profiles, and the probabilities of a match ranged from a low of one in 250,000 (Native American) to a high of one in 250 million (Caucasian). Curiously, however, the 200-person Native American database was composed of 100 Sioux plus Navajo, Cherokee, and Cheyenne tribes, but no Crow.

The defense aggressively challenged the findings of the prosecution concerning the statistical probabilities of a match. Specifically, the defense expert claimed that because the Native American tribes were each a subgroup of a subgroup of a racial classification, the possibility of error was substantial. The court described the testimony as follows:

According to [the defense expert], Indian tribes are a “subgroup of a subgroup of a racial classification.” In looking at the same allele segments used by the FBI in their analysis, Dr. Shields cited major differences that exist between Native American groups in Canada, which constituted a “monstrous allele frequency difference.” In another example, [the expert] discussed . . . findings . . . concerning “statistically significant allele frequency differences” among two South American tribes living 300 miles apart and a tribe in Mexico. The underlying theory that supports the frequency differences is called endogamous breeding, or a tendency for individuals to mate “with individuals that they grew up with; in essence, individuals from the same geographic locale, the same ethnic group, the same religion, the same socioeconomic status.” In sum, . . . “If you use the appropriate database, you may actually find lots of matches. If you used the wrong database, you may have none. . . .”³²

The court remarked that the defendant did not put in any evidence that the Crow tribe was endogamous and held that “any questions concerning the size of the database or the

cording to the law in *Pennington*.

³¹*Springfield v. State*, 860 P.2d 435 (Wyo. 1993).

³²*Id.* at 446.

Hardy-Weinberg equilibrium goes to the weight of the evidence and is properly left to the jury.”³³ Rather, the court determined that the potential impact of substructure on the accuracy of the estimates is a matter of weight, not admissibility. The court in *Springfield* relied on an earlier case, *Rivera v. State*,³⁴ which had determined that the proper approach to the admission of DNA (and other scientific) testimony was an analysis of relevancy, rather than a *Frye*-type approach. “Relevancy is the ‘linchpin of admissibility’ and is preferable to the ‘general acceptance’ approach of *Frye* which is predicated on a ‘nose counting’ . . .”³⁵

Rather, the approach of the Wyoming court is to throw the matter to the jury once the court is satisfied that there is a “requisite foundation” for the evidence. The Wyoming Supreme Court stated:

We agree that the “focus of the court must be on ‘the admissibility or non-admissibility of a particular type of scientific evidence,’ not ‘the truth or falsity of an alleged scientific “fact” or “truth.”

In other words, the court need not make the initial determination that the expert testimony or the evidence proffered is true before submitting the information to the jury. The court must allow the jury to discharge its duties of weighing the evidence, making credibility determinations, and ultimately deciding the facts.”³⁶

Additionally, in this case, the court was satisfied that the introduction into evidence of the ceiling principle, recommended by the NRC Report, provided the most conservative—and acceptable—estimate for the courts.

One of the most recent state courts to admit DNA evidence is New Mexico, in *State v. Anderson*.³⁷ The Supreme Court of New Mexico reversed the Court of Appeals of New Mexico in this case, determining that under the newly adopted standard of admissibility, the DNA evidence should be admitted.

³³Id. at 447.

³⁴*Rivera v. State*, 840 P.2d 933 (Wyo. 1992).

³⁵860 P.2d at 442.

³⁶Id. at 443.

³⁷*State v. Anderson*, 881 P.2d 29 (N.M. 1994). *State v. Duran*, 881 P.2d 48 (N.M. 1994), was also decided that same day and is in accordance with the holding of *Anderson*.

Between the court of appeals decision in *Anderson* and the supreme court decision, the court changed the standard of admissibility of novel scientific evidence. In *State v. Alberico*,³⁸ New Mexico abandoned the *Frye* test and decided to admit novel scientific evidence pursuant to a three-part standard. “The first requirement is that the expert be qualified.”³⁹ “The second consideration for the admissibility of scientific evidence in the form of expert testimony is whether it will assist the trier of fact.”⁴⁰ The third requirement is that “an expert may testify only as to ‘scientific, technical or other specialized knowledge’” with a reliable basis.⁴¹

To determine whether the evidence was “reliable,” the *Alberico* court followed the four factors cited by the *Daubert v. Merrell Dow Pharmaceuticals*⁴² decision.⁴³ Using these tests, the supreme court in *Anderson* cited a number of other jurisdictions with relevancy standards that admitted DNA evidence.⁴⁴ Additionally, the court followed the holding in *United States v. Bonds*⁴⁵ where the Sixth Circuit determined that the DNA evidence had met the *Daubert* standard for admissibility.

Unlike the *Bonds* court, however, the *Anderson* court did examine the NRC Report and found the report to be supportive of admitting DNA evidence. “We find the report persuasive and would like to see DNA typing in this state performed with the report’s guidelines in mind, specifically

³⁸State v. Alberico, 861 P.2d 192 (N.M. 1993).

³⁹Id. at 202.

⁴⁰Id.

⁴¹Id.

⁴²Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993).

⁴³The four-part test suggested by *Daubert* is: (1) whether the theory or technique can and has been tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rate of error in using a particular scientific technique and the existence and maintenance of standards controlling the technique’s operation; and (4) whether the theory or technique has been generally accepted in the particular scientific field. 509 U.S. at 591-593.

⁴⁴See cases collected at 881 P.2d 40.

⁴⁵United States v. Bonds, 12 F.3d 540 (6th Cir. 1993). *Bonds* is discussed at length at § 11:36-11:39.

the ‘ceiling principle’ approach.”⁴⁶ Further, the court determined that the “modified ceiling principle” could be used immediately in the courts.⁴⁷

Thus, with that provision and with the determination that the effect of population substructure went to the weight of the evidence, not the admissibility, the court held:

In conclusion, we hold that the trial court did not abuse its discretion in concluding that the DNA typing evidence and the accompanying statistical calculations in this case were admissible. Any controversy over the results of the testing and the statistical calculations goes to the weight of the evidence and is properly left to the trier of fact.⁴⁸

In 1995, a number of states approved the admission of DNA evidence, finding that many of the previously voiced concerns were no longer relevant.⁴⁹ Significant to some courts was the 1994 article by Lander and Budowle, entitled *DNA Fingerprinting Dispute Laid to Rest*,⁵⁰ which stated: “Most of all, the public needs to understand the DNA fingerprinting controversy has been resolved. There is no scientific reason to doubt the accuracy of forensic DNA typing results, provided that the testing laboratory and the specific tests

⁴⁶881 P.2d at 47.

⁴⁷In this case, after a hearing in which the prosecution’s experts testified that the likelihood of a match was “1 in 30.5 million,” the trial court indicated it would admit the DNA evidence. The defendant entered a conditional plea and the issue of DNA’s admissibility was preserved for the appeal. On appeal, the court of appeals reversed the trial court’s decision, finding that the *Frye* standard was not met. The *Alberico* decision did away with the *Frye* test and this decision followed, which upheld the modified ceiling principle’s use in DNA cases. Thus, the anticipated result is that the defendant’s guilty plea would still be viable, but the “1 in 30.5 million” number would be substantially reduced.

⁴⁸881 P.2d at 47-48.

⁴⁹See, e.g., *Lindsey v. People*, 892 P.2d 281 (Colo. 1995); *Hayes v. State*, 660 So. 2d 257 (Fla. 1995)(admissible upon retrial); *State v. Haddock*, 897 P.2d 152 (Kan. 1995)(holding both PCR and RFLP evidence admissible); *People v. Lee*, 537 N.W.2d 233 (Mich. App. 1995), appeal denied, 554 N.W.2d 12 (Mich. 1996) (PCR evidence admissible if prosecutor establishes generally accepted laboratory procedures were followed); *State v. Streich*, 658 A.2d 38 (Vt. 1995)(adopting *Daubert* and limiting admissibility to ceiling principle results); and *Taylor v. State*, 889 P.2d 319 (Okla. Crim. App. 1995) (adopting *Daubert* and admitting DNA evidence without limitation of ceiling principle).

⁵⁰Lander & Budowle, *DNA Fingerprinting Dispute Laid to Rest*, *Nature*, Oct 27, 1994, at 735.

are on par with currently practiced standards in the field.”⁵¹

**§ 11:48 Jurisdictions admitting DNA evidence—
United States v. Bonds: a key decision
admitting DNA**

An early and influential case upholding the admission of DNA evidence was *United States v. Bonds*.¹ In *Bonds*, the Court of Appeals for the Sixth Circuit approved of the admission of the RFLP type DNA test results, specifically declining to remand the case to consider the effect, if any, of the NRC Report. The court stated:

There is no dispute that the NRC Report exists, but there is considerable dispute over the significance of its contents. We acknowledge that several appellate courts have considered the NRC Report retroactively, asked the parties to brief the significance of the report, or remanded for consideration of it [citations omitted]. However, we do not agree with those courts that have considered the NRC Report retroactively or remanded for consideration of it, and we decline to take judicial notice of an article published a year after defendant’s convictions were handed down.²

The court in *Bonds* went on to say that the “key is whether the testimony met the requirements of Federal Rule of Evidence 702 at the time of the district court’s admissibility determination, not whether subsequent events provide evidence that contradicts or calls into question the district court’s view at the time of its admissibility ruling.”³

The *Bonds* court, although it did not consider the NRC

⁵¹Id. at 738.

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¹*United States v. Bonds*, 12 F.3d 540 (6th Cir. 1993), reh’g denied, 1994 U.S. App. LEXIS 3679, aff’g *United States v. Yee*, 134 F.R.D. 161 (N.D. Ohio 1991).

²Id. at 553.

³Id. Taken at face value, this statement is nothing short of remarkable. In essence, the court is proclaiming that it is irrelevant if the science was wrong at the time of conviction as the court of appeals’ role is only to review whether the trial court erred—given what they knew at the time of trial. Taken to its extreme, that would mean that in a case in which scientific proof of innocence discovered post-conviction that wholly contradicted the trial evidence would be irrelevant to the reviewing court. While in the case at bar the result may not have been different, the precedent it created is on shakier grounds.

Report, provided a thorough review of the science as it was presented in the trial court and employed the four-part test of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*⁴ in its analysis.⁵

As recommended by the *Daubert* court, the Sixth Circuit in *Bonds* focused on whether the “principles and methodology” underlying the testimony are valid and not on “the reliability of the conclusions.”⁶ Using this analysis, the *Bonds* court concluded that the evidence met the “liberal Rule 702 test adopted by the Supreme Court.”⁷ The following is a summary of the opinion of the Sixth Circuit Court of Appeals.⁸

Using the “relevant-reliable” approach suggested by *Daubert*, the court went through each of the four *Daubert* prongs, and found the test satisfied.

§ 11:49 Jurisdictions admitting DNA evidence—*United States v. Bonds*: a key decision admitting DNA—Testing of theory or technique

First, the court held that the technique of DNA testing could be tested, stating that “the particular technique employed by the FBI lab, can in fact be tested by comparing the results generated from one set of samples with the results reached after repeating the matching and probability estimate process on control samples.”¹

The court found that the FBI’s testing methods were subject to internal proficiency standards and were found to

⁴*Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993).

⁵The four-part test suggested by *Daubert* is: (1) whether the theory or technique can and has been tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rate of error in using a particular scientific technique and the existence and maintenance of standards controlling the technique’s operation; and (4) whether the theory or technique has been generally accepted in the particular scientific field. 509 U.S. at 591-593.

⁶12 F.3d at 556.

⁷*Id.* at 557.

⁸The *Bonds* decision is given more extensive analysis, due to the highly influential nature of the case and the fact that most—if not all—of the prominent DNA experts on both sides testified in the case.

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¹*Id.* at 558.

be reliable and further that their theories, principles, methods, and techniques could be tested and have in fact been tested. The court did note that while the FBI's proficiency testing program had "serious deficiencies," such deficiencies did not affect the reliability of the testing procedures.

**§ 11:50 Jurisdictions admitting DNA evidence—
United States v. Bonds: a key decision
admitting DNA—Peer review**

Normally, results of a science in its developing stages will be published in a peer-review journal once enough scientists have decided that the results are worthy of publication. Thus, such publication is considered an important measure of whether a scientific theory or technique has attained a threshold of reliability.

Although very few articles were actually "peer-reviewed journal" articles, the court found that there were enough articles published about the FBI's procedures to enable it to meet this prong of the analysis. The court also stated that "[i]n addition, the magistrate in this case anticipated Daubert by concluding that expert testimony from experts outside the proponents' lab and acceptance of the proponent's writings in professional journals—in essence peer evaluation or review—were factors to consider in determining general acceptance and thus admissibility."¹

**§ 11:51 Jurisdictions admitting DNA evidence—
United States v. Bonds: a key decision
admitting DNA—Rate of error**

The court remarked that it was troubled by the "serious deficiencies" in the internal proficiency tests that were conducted to perform a rate of error analysis. Despite this concern, the court nonetheless concluded that "the error rate is only one in a list of nonexclusive factors . . . that bear on . . . admissibility."¹ Thus, the court seemed to be content to pass on this issue, despite the fact that this issue should be

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¹Id. at 560.

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¹Id. at 560.

much more troubling to the court, since it may suggest that the test itself is flawed.

**§ 11:52 Jurisdictions admitting DNA evidence—
United States v. Bonds: a key decision
admitting DNA—General acceptance**

The final category of reliability, general acceptance, was changed by the *Daubert* decision to be one of the inquiries for the court, rather than the only inquiry.¹ In this rather lengthy discussion, the court stated:

In examining “general acceptance” and in addressing the parties’ arguments, we are confronted in this case with the question of what exactly must be generally accepted: whether only the theory of DNA profiling needs to be accepted or whether the FBI’s methodology for conducting DNA testing need also to be generally accepted. . . . We find that general acceptance encompasses both.²

What is surprising about this decision is that the court did not merely re-focus the factors to be considered by a court concerning novel scientific evidence, but in fact it changed its own interpretation of the phrase “general acceptance.” The *Bonds* court remarked that pre- *Daubert* cases had interpreted “general acceptance” to mean that “a substantial portion of the pertinent scientific community accepts the theory, principles, and methodology underlying scientific testimony because they are grounded in valid scientific theory.”³

The new interpretation of “general acceptance,” however, does not require unanimity, or even consensus, within the scientific community. Rather, the test is one of exclusion, rather than inclusion. “Only when a theory or procedure does not have the acceptance of most of the pertinent scientific community, and in fact a substantial part of the scien-

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¹Likewise, the importance of the “general acceptance” test became reduced with the adoption of the *Daubert* standard. Now, it is merely one factor and need not be actually met to provide acceptance of the science. For further discussion of this subject see Scheck, DNA and Daubert, 15 Cardozo L Rev 1959 (1993).

²12 F.3d at 562.

³Id. at 561.

tific community disfavors the principle or procedure, will it not be generally accepted.”⁴

The court’s holding in *Bonds* on what constitutes “general acceptance” is at odds with prior case law in its circuit as well as with other cases around the country.⁵ Nonetheless, the court used this standard in the instant case and held that “the defendants’ experts did not in fact show that the procedures were not generally accepted; they only showed a substantial controversy over whether the results produced were reliable and accurate.”⁶ Since the focus—according to *Daubert*—was on “principles and methodology” and not on conclusions, however, the court had little trouble finding that the general acceptance was met.

The court then moved on to the substance of the defendant’s contentions—namely, whether the statistical probability estimates were not generally accepted in the scientific community. The *Bonds* court held that the issue of the viability of population substructure was a dispute over the accuracy of the probability results that went to the weight of the evidence, not to the admissibility of such evidence. It stated:

The evidence and testimony presented . . . demonstrate that the DNA evidence was not based on untested or unacceptable theories or procedures. Because the DNA results were based on scientifically valid principles and derived from scientifically valid procedures, it is not dispositive that there are scientists who vigorously argue that the probability estimates are not accurate or reliable because of the possibility of ethnic substructure. The potential of ethnic substructure does not mean that the theory and procedure used by the FBI are not

⁴Id. at 562.

⁵Some courts require a “consensus,” or the absence of public opposition by “scientists significant either in number or expertise,” as a prerequisite for “general acceptance.” See *People v. Reilly*, 196 Cal. App. 3d 1127, 1134-45 (1987); *State v. Cauthron*, 846 P.2d 502, 505 (Wash. 1993), abrogated on other grounds, *State v. Copeland*, 922 P.2d 1304 (Wash. 1995).

Scheck, DNA and Daubert, 13 Cardozo L Rev 1959, 1960, n.4 (1993). The *Cauthron* court went so far as to state that a “trial court’s determination cannot be sustained, for example, on a mere finding that the record contains ‘sufficient evidence’ of the reliability of the challenged method.” 846 P.2d at 506.

A more complete discussion of these tests is contained in Chapter 10, *supra*.

⁶12 F.3d at 562.

generally accepted; it means only that there is a dispute over whether the results are as accurate as they might be and what, if any, weight the jury should give those results.⁷

The *Bonds* decision has been cited and followed by a number of courts since it was published. The wisdom of the decision has been questioned by those who believe that the court's rush to admit DNA evidence has adversely affected the quality of the court's analysis.⁸

§ 11:53 [Reserved]

§ 11:54 Jurisdictions disallowing or limiting DNA evidence

Although most jurisdictions have allowed—at least on a limited basis—forensic DNA results to be admitted at trial, some courts have expressly disallowed such testimony until such time as either the court is convinced that the science meets the *Frye* standard of acceptability or there is more uniformity in the opinions of those in the field.

The first court to really question DNA evidence before the existence of the NRC Report was Massachusetts. Other states subsequently followed, but primarily after the NRC Report.

§ 11:55 Jurisdictions disallowing or limiting DNA evidence—The early cases

One of the first cases to disallow DNA testing using the RFLP analysis was *State v. Schwartz*.¹ In *Schwartz*, the Supreme Court of Minnesota first rejected a move to change the *Frye* standard to a relevancy standard, stating that “without this safeguard [of general acceptance], we believe an undesired element of subjectivity is possible in evidentiary rulings under the relevancy approach. The *Frye* standard, on the other hand, facilitates more objective and

⁷Id. at 564-65.

⁸See, e.g., *State v. Moore*, 885 P.2d 457 (Mont. 1994), overruled on other grounds, *State v. Gollehon*, 906 P.2d 697 (Mont. 1995).
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¹*State v. Schwartz*, 447 N.W.2d 422 (Minn. 1989).

uniform rulings.”²

In *Schwartz*, Minnesota determined, on the basis of the *Frye* hearing in which numerous experts testified, that although DNA typing was generally reliable, Cellmark’s admissions of errors in a proficiency test cast grave doubts upon the reliability of the laboratory’s testing procedures. Thus, the court held that:

While we agree with the trial court that forensic DNA typing has gained general acceptance in the scientific community, we hold that admissibility of specific test results in a particular case hinges on the laboratory’s compliance with appropriate standards and controls, and the availability of their testing data and results Because the laboratory in this case did not comport with these guidelines, the test results lack foundational adequacy and, without more, are thus inadmissible.³

The *Schwartz* court made an additional limitation on the use of population frequency statistics, requiring that “a limitation on the use of [such evidence] is necessary because of the danger that such evidence will have a ‘potentially exaggerated impact on the trier of fact.’”⁴

Minnesota has an interesting rule concerning the admissibility of statistical evidence, termed the “Carlson-Boyd-Kim” trilogy, which precludes experts from expressing an opinion in terms of statistical probabilities. The reason for this rule is that “[t]estimony expressing opinions or conclusions in terms of statistical probabilities can make the uncertain seem all but proven, and suggest, by quantification, satisfaction of the requirement that guilt be established ‘beyond a reasonable doubt.’”⁵

In the case of *State v. Alt*,⁶ the Minnesota Supreme Court followed the “Carlson-Boyd-Kim” trilogy and remanded the

²Id. at 424.

³Id. at 428.

⁴Id. at 428, quoting *State v. Joon Kyu Kim*, 398 N.W.2d 544 (Minn. 1987). Subsequent to *Schwartz*, the Minnesota legislature enacted a statute allowing DNA evidence to be admitted, 1989 Minn Stat § 634. Additionally, the holding in *State v. Alt*, 504 N.W.2d 38 (Minn. App. 1993) appeared to adopt the “ceiling principle” recommended by the NRC Report and thus, affected the holding of *Schwartz*.

⁵*State v. Bloom*, 516 N.W.2d 159, 164 (Minn. 1994), citing *Tribe, Trial by Mathematics*, 84 Harv L Rev 1329.

⁶*State v. Alt*, 505 N.W.2d 72 (Minn. 1993).

lower court decision, finding that the only DNA frequency evidence to be admitted at trial is the population frequency evidence of the individual bands.

In the *Bloom* case, however, the Minnesota Supreme Court, in a lengthy and well-researched opinion detailing the objections to DNA evidence, held that DNA evidence could be admissible and additionally determined that the prior limitations on statistical evidence were not necessarily appropriate for DNA cases. The high court held:

[F]irst, that the National Research Council's recent adoption of the conservative, "interim ceiling method" for computation of the probability that a randomly selected person would have the same DNA profile as that of a sample of bodily fluids found at a crime scene justifies the creation of a DNA exception to the rule against the admission of statistical probability evidence in criminal prosecutions to prove identity; second, that if the evidentiary foundation provided by the proponent of the evidence is sufficient, a properly qualified expert may express the opinion that, to a reasonable degree of scientific certainty, the defendant is (or is not) the source of the bodily evidence found at the crime scene.⁷

Thus, under the *Bloom* exception, the expert, if the foundation is sufficient, may "give an opinion as to random match probability using the NRC's approach to computing that statistic."⁸

The Supreme Judicial Court of Massachusetts, in *Commonwealth v. Curnin*,⁹ also disallowed the admission of DNA evidence, where the court held that "evidence of DNA testing was inadmissible because the methods used by Cellmark to calculate the statistical probability of a random match were not generally accepted by the relevant scientific

⁷516 N.W.2d at 160. Given the court's focus in this case on the numerous possible error as well as the difficulty of accurate statistical probability in DNA testing, the abrupt conclusion the court reaches is difficult to understand. Nevertheless, the case is replete with discussions of errors in DNA testing which makes it a helpful primer for those needing to know where DNA testing can fail.

⁸Id. at 167.

⁹*Commonwealth v. Curnin*, 565 N.E.2d 440 (Mass. 1991). *Curnin* was substantially overruled by *Commonwealth v. Lanigan*, 641 N.E.2d 1342 (Mass. 1994)(*Lanigan II*), where the court held that DNA evidence was reliable and should be admitted.

community.”¹⁰

§ 11:56 Jurisdictions disallowing or limiting DNA evidence—Post-1992 NRC Report cases

Following the publication of the 1992 NRC Report, several courts were concerned enough about DNA testing to preclude or limit such evidence. One of the first courts to question the appropriateness of DNA evidence was the California Court in *People v. Barney*.¹ In *Barney*, the trial court conducted a “Kelly-Frye” hearing² and determined that “the statistical significance of a match between a defendant’s DNA and the DNA in bodily material found at the crime scene . . . does not satisfy the Kelly-Frye test.”³ The *Barney* court took notice of the appellate court’s decision in *People v. Axell*⁴ holding that DNA testing and statistical interpretation met the *Kelly-Frye* standard. However, the court in *Barney* determined that the new debate ongoing in the scientific field concerning the value of statistical interpretation needed further review.

According to the Kelly-Frye standard, the admissibility of novel scientific evidence is predicated on the following:

- (1) the reliability of the method must be established, usually by expert testimony, and (2) the witness furnishing such testimony must be properly qualified as an expert to give an opinion on the subject. . . . Additionally, the proponent of the

¹⁰Id.

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¹*People v. Barney*, 10 Cal. Rptr. 2d 731 (Cal. App. 1992). In 1998, the Supreme Court of California clarified much of the confusion that has surrounded DNA evidence and held that: (1) the RFLP method of DNA analysis was generally accepted; and (2) use of the modified ceiling statistical analysis method was also generally accepted. See *People v. Venegas*, 954 P.2d 525 (Cal. 1998).

²This refers to the California test combining the *Frye* test with the test enunciated in *People v. Kelly*, 130 Cal. Rptr. 144 (Cal. 1976). See *People v. Leahy*, 882 P.2d 321 (Cal. 1994). This test is discussed at length in Chapter 10.

³10 Cal. Rptr. 2d at 732.

⁴*People v. Axell*, 1 Cal. Rptr. 2d 411 (Cal. App. 1991). For the current view of California law concerning DNA, see *People v. Venegas*, 954 P.2d 525 (Cal. 1998); and *People v. Soto*, 981 P.2d 958 (Cal. 1999).

evidence must demonstrate that correct scientific procedures were used in the particular case.⁵

“Reliability,” according to the California courts, is synonymous with the concept of “general acceptance.”

The court conducted a *de novo* review⁶ of whether the science met the general acceptance test and found—as have other courts—that the theory and technique of DNA testing meets the general acceptance tests, but that the issue of statistical interpretation poses more difficult problems. The court thus focused its discussion on this latter problem, laying out the controversy in a lengthy discussion of each side’s principles.

The court held that the statistical issues are not a question of weight, but of admissibility. Quoting *Axell*, the court here stated that “since a match between two DNA samples means little without data on probability, the calculation of statistical probability is an integral part of the process and the underlying method of arriving at that calculation must pass muster under *Kelly/Frye*.”⁷ The court further reasoned that the jury should not be made to weigh the competing positions on statistical calculation and, in one of the better reasoned approaches to statistical interpretation and the honest difficulty it would pose for jurors, concluded:

We would be asking jurors to do what judges carefully avoid—decide the substantive merits of competing scientific opinions as to the reliability of a novel method of scientific proof. We cannot reasonably ask the average juror to decide such arcane questions as whether genetic substructuring and linkage

⁵10 Cal. Rptr. at 737 (citations omitted). Whether the proper scientific procedures were used in the particular case is referred to as the “third prong” of the *Frye* analysis and, while not a part of all *Frye* jurisdictions, is a part of California’s jurisprudence. As the *Barney* court stated later in its opinion, “the third prong of *Kelly-Frye* is alive and well, and is not merely a question of weight but is an element of the *Kelly-Frye* admissibility determination” *Id.* at 746. Accord, *People v. Venegas*, 954 P.2d 525 (Cal. 1998). For a differing opinion, see *State v. Mohit*, 579 N.Y.S.2d 990 (1992), holding that this third prong goes to the weight, not the admissibility of such evidence.

⁶Like other courts using a *Frye* standard, the appellate courts conduct a *de novo* review of the evidence and do not employ the abuse of discretion standard generally used by courts with a relevance or “helpfulness” test. See Chapter 10, *supra*, for discussion of *de novo* review.

⁷*Id.* at 742.

disequilibrium preclude use of the Hardy-Weinberg equation and the product rule, when we ourselves have struggled to grasp these concepts. The results would be predictable. The jury would simply skip to the bottom line—the only aspect of the process that is understood—and look at the ultimate expression of match probability, without competently assessing the reliability of the process by which the laboratory got to the bottom line. This is an instance in which the scientific proof is so impenetrable that it would “. . . assume a posture of mystic infallibility in the eyes of the jury. . . .”⁸

Thus, holding that the matter is one of admissibility and not weight, the court analyzed the controversy and concluded that “the debate that erupted in *Science* in December 1991⁹ changed the scientific landscape considerably, and demonstrates indisputably that there is no general acceptance of the current process.”¹⁰

Further, the court in *Barney* held that unless the proper scientific procedure was established in each case, the evidence would be inadmissible under *Kelly-Frye*, although the nature of the hearing would be limited.¹¹ The court in *Barney* (and in the companion action) declined to reverse the conviction, however, finding the error to be harmless.

The *Barney* rationale was upheld in a case that was decided shortly thereafter, *People v. Wallace*,¹² where the court held it was an error to admit testimony concerning DNA evidence, although the court again deemed that the admission of such evidence was harmless. In the *Wallace* case, the Attorney General urged the court to reconsider *Barney*, claiming that there are more supporters of DNA testing and that those supporters are correct. The *Wallace* court correctly noted that such an argument misconstrues

⁸Id. at 742, citing *People v. Kelly*, 130 Cal. Rptr. 144 (Cal. 1976), and *United States v. Addison*, 498 F.2d 741, 744 (D.C. Cir. 1974).

⁹This reference is to the Lewontin-Hartl and the Chakraborty-Kidd articles, discussed earlier in the chapter.

¹⁰Id. at 744.

¹¹See also *State v. Jobe*, 486 N.W.2d 407 (Minn. 1992), where the Minnesota court reached a similar holding, requiring only a limited *Frye* hearing to ensure that the laboratory in question did the testing in compliance with appropriate standards and controls, but there was no need to re-challenge the based RFLP testing procedures as a whole, since they had reached a general acceptance level.

¹²*People v. Wallace*, 17 Cal. Rptr. 2d 721 (Cal. App. 1993).

the issue: “[T]he point is not whether there are more supporters than detractors, or whether . . . the supporters are right and the detractors are wrong. The point is that there is disagreement between the two groups, each significant in both number and expertise. . . .”¹³

In *People v. Venegas*¹⁴ the court of appeals agreed that genetic profiling evidence and statistical probability evidence are generally admissible, but found that the FBI failed to perform analysis in accordance with accepted methodology. As evidenced by these cases, the debate seems to have turned full circle as scientific questions are resolved and techniques are refined.

In 1992, the Supreme Judicial Court of Massachusetts issued an opinion in *Commonwealth v. Lanigan*¹⁵ which determined that the current debate concerning population substructure—as evidenced by the NRC Report—indicated that the evidence did not meet the *Frye* standard of admissibility. The court held:

“[N]either infallibility nor unanimous acceptance of the principle need be proved to justify its admission in evidence.” However, the lively, and still very current, dispute described above regarding the role of population substructure constitutes something much more than a lack of unanimity. We cannot say that the processes by which Cellmark and the FBI estimated the frequency of the defendants’ DNA profiles has found “general acceptance” in the field of population genetics. Accordingly, evidence of the estimated frequencies of the defendants’ DNA profiles is not admissible. Because the frequency estimates are inadmissible, evidence of a match between profiles is also inadmissible.¹⁶

Although the court did note that they would be inclined to follow the “ceiling principle” if it had been introduced in the case at bar, it opined: “The national call for considered, conservative approaches to DNA testing, such as the use of ceiling frequencies, and the absence of such an approach in the

¹³Id. at 725-26, quoting *Barney*.

¹⁴*People v. Venegas*, 954 P.2d 525 (Cal. 1998),.

¹⁵*Commonwealth v. Lanigan*, 596 N.E.2d 311 (Mass. 1992).

¹⁶Id. at 162, quoting *Commonwealth v. Lykus*, 367 Mass. 191, 198 (1975).

present cases, underscore the wisdom of the motion judge in excluding the test evidence.”¹⁷

This decision was reaffirmed the following year by the Supreme Judicial Court in *Commonwealth v. Daggett*,¹⁸ although any error in admission was determined to be harmless. As stated earlier in the *Curnin* case, without statistical certainty, DNA evidence was meaningless. Thus, noting that Massachusetts still adhered to the *Frye* test for admissibility, the court pointed out that the failure of the DNA testing at hand was still in the significance of the statistical frequency and should be inadmissible. As the court stated, “[t]he point is not that this court should require a numerical frequency, but that the scientific community clearly does. If the relevant scientific community generally accepted some nonnumerical expression of statistical frequency, then this court would likely accept it as well.”

Massachusetts subsequently followed the national trend of admitting DNA evidence when it held, in *Commonwealth v. Lanigan*,¹⁹ that the reliability of the process had been established and the evidence of the probability of a DNA match had been properly admitted.

Perhaps the most scientifically detailed opinion to date to disallow DNA testing evidence is *State v. Bible*.²⁰ The *Bible* case, like other cases disallowing DNA evidence, used a de novo standard of review under *Frye* to determine whether the expert testimony is generally accepted in the scientific community.²¹

The *Bible* decision is an important review of the law concerning the appropriate standard for cases involving novel scientific evidence, aptly remarking that “*Frye* helps us determine whether new scientific principles are ready for

¹⁷Id. at 163-64.

¹⁸*Commonwealth v. Daggett*, 622 N.E.2d 272 (Mass. 1993)(plurality opinion).

¹⁹*Commonwealth v. Lanigan*, 641 N.E.2d 1342 (Mass. 1994)(Lanigan II).

²⁰*State v. Bible*, 858 P.2d 1152 (Ariz. 1993), cert. denied, 511 U.S. 1046 (1994). For an in-depth analysis of the *Bible* case, see Note, *State v. Bible: The Admissibility of Forensic DNA Profiling and Statistical Probability Evidence in Arizona Criminal Proceedings*, 26 *Ariz St LJ* 593 (1994).

²¹858 P.2d at 1181, citing to *Barney*, *Vandebogart*, and *Cauthron*, all discussed at length in this section.

the courtroom and, conversely, whether the courtroom is ready for new scientific principles.”²²

In *Bible*, the court declined to adopt a different standard than *Frye*, although noting that it believed the evidence would be inadmissible—in its opinion—even under the *Daubert* standard.²³ The court’s opinion on the scientific evidence and the role of the *Frye* standard is worth repeating:

It is impossible for our system of justice to ignore scientific and technological advances. Nevertheless, scientific evidence is “a source of particular judicial caution.” [citation omitted]. “Because, ‘science’ is often accepted in our society as synonymous with truth, there is a substantial risk of overweighing by the jury.” Morris K. Udall, et al., Arizona Practice—Law of Evidence sec. 102, at 212 (3d ed. 1991). Similarly, because neither judge nor jury may be able to separate “junk science” from good science, *Frye* helps guarantee “that reliability will be assessed by those in the best position to do so: members of the relevant scientific field who can dispassionately study and test the new theory.” [citation omitted]. *Frye* helps protect courts from unproven, and potentially erroneous and misleading, scientific theory “until a pool of experts is available to evaluate it in court.” 1 John W. Strong, et al., McCormick on Evidence sec. 203, at 873 (4th ed. 1992).²⁴

With the above caveats in mind, the court went on to analyze the evidence to determine whether DNA testing evidence met the *Frye* standard for general admissibility

The *Bible* court, like other courts, found that there was no significant scientific controversy over Cellmark’s analysis of DNA fragments and its method for declaring a match. But, like numerous other courts, the calculation of a the probability of a random match troubled the court.

The court focused on three concerns: whether the database from which the statistical calculations were to be made was a truly random sampling; whether the DNA segments tested were actually in linkage equilibrium; and whether the

²²Id. at 1181.

²³The court did indicate that it might be amenable to changing its standard to a different one, but that DNA proved a particularly bad subject on which to create such a change.

²⁴Id. at 1181.

population engages in truly random mating, such that the Hardy-Weinberg equilibrium is established.²⁵

A point troubling to this court—and generally not mentioned by other courts—was that not only did a larger percentage of scientist disapprove than approve of the forensic use of DNA testing, but that “the ratio of critics to supporters is higher among scientists whose work is better known in the field of population genetics.”²⁶

Thus, based upon the “bitter dispute” ongoing among scientists concerning the statistical probability of calculations used by Cellmark and the fact that several other courts²⁷ also found a lack of general acceptance on that point, the Arizona Supreme Court held that the “Cellmark method of deriving the random match probability figures is not generally accepted in the relevant scientific community.”²⁸ The court determined the probability calculations were flawed in three ways: “(1) they are impermissibly based on the disputed assumptions of linkage equilibrium; (2) the database relied on is of disputed statistical validity; and (3) the database relied upon is not in Hardy-Weinberg equilibrium.”²⁹

The court determined error had been committed in the case by the admission of such evidence, although noting that it was difficult to term the judge’s ruling erroneous, in light of the fact that most of the dispute over DNA occurred after the trial court’s ruling. The conviction, however, was not dismissed, since the court found that the quantum of evidence against the defendant was overwhelming and thus any error was harmless.

As a final note, the court acknowledged that while some courts found that without statistical interpretation of the meaning of a match between two DNA profiles, DNA testimony is meaningless, other courts “uncoupled” the statistical evidence from the match evidence. Thus, testimony could conceivably be admissible to establish—without statistical evidence—that the sample found at the crime

²⁵Id. at 1185-86.

²⁶Id. at 1188, citing inter alia Thompson & Ford, DNA Testing: Debate Update, 28 Trial 52, 58 (Apr. 1992).

²⁷Those other decisions are reviewed in this section.

²⁸Id. at 1188.

²⁹Id.

scene *could* have come from the defendant (or victim, if that was the case). The court, however, did not express any opinion on whether such evidence would be admissible in another case.

Curiously, unlike most other cases that were published after the NRC Report, the *Bible* decision makes no mention of the viability of the ceiling principle or its application to the case in question.³⁰

In *State v. Cauthron*,³¹ the defendant was accused and convicted on seven counts of first-degree rape, relating to a series of rapes that had occurred—with an identifiable *modus operandi*—over a two year period. Five of the semen samples of the seven cases in which semen was recovered were matched to the defendant's DNA sample. Additionally, there was a rare enzyme found in the defendant's blood that was also found in the semen and was present in less than one percent of the population.

The Supreme Court of Washington accepted the case on certification from the lower court and conducted a review of the case according to the *Frye* standard. The *Cauthron* court did not confine itself to reviewing just the lower court's decision for error, but rather reviewed the “record, available literature of law reviews and other journals, and the cases of other jurisdictions.”³² In *Cauthron*, as in many other significant DNA cases, the trial court had heard several days of hearings, with thousands of pages of transcripts as well as extensive briefs.

The Supreme Court of Washington followed the lead of Massachusetts in deciding to disallow evidence of the RFLP type of DNA testing. The NRC Report came out after the court heard oral argument, but before the court issued its

³⁰The court's citation to the *Vandebogart*, *Cauthron*, and *Barney* cases would suggest that it was aware of the ceiling principle. In 1996, the Washington Supreme Court, in *State v. Copeland*, 922 P.2d 1304 (Wash. 1996), held that DNA evidence was admissible and there was no need to use the ceiling principle. So too, the Arizona Supreme Court upheld the admission of DNA evidence without the use of any ceiling principles. See *State v. Boles*, 933 P.2d 1197 (Ariz. 1997).

³¹*State v. Cauthron*, 846 P.2d 502, 505 (Wash. 1993), abrogated on other grounds, *State v. Copeland*, 922 P.2d 1304 (Wash. 1995).

³²*Id.* at 506. Significantly, the Supreme Court of Washington also undertakes a *Frye* determination de novo, and not under an abuse of discretion standard. *Id.* at 507, n.4.

opinion. Accordingly, the court requested additional briefing on the applicability of the Report.³³

The court in *Cauthron* conducted a complete analysis of the *Frye* standard of admissibility, noting that Washington was disinclined to accept a newer, more liberal test and stating that “the court is less inclined to admit evidence which is still disputed in the scientific community [citations omitted]. Thus, in making the initial determination to allow novel scientific evidence, we do not examine its reliability, but instead focus on whether it is generally accepted in the scientific community.”³⁴

The court noted that the DNA commentary had identified a variety of potential problems with RFLP tests performed on forensic samples: contamination of the sample; degradation of the sample due to the passage of time; partial digestion of the fragments by the restriction enzyme; cuts by the enzyme in too many places; cross-contamination and human error in the laboratory.³⁵

These potential problems with DNA testing did not trouble the court in their *Frye* analysis. Rather, these were the types of problems that the court should properly let the two sides introduce expert testimony about before the jury and ask the fact-finder to resolve the dispute. These issues were not whether the *science* of DNA and the *method* of testing were generally accepted, but rather whether there were errors that occurred in this testing procedure of which the jury should be apprised. Specifically challenged were the processes used by the Cellmark laboratory and whether the autorads were inconclusive.

³³This court, as well as the Supreme Court of New Mexico in *State v. Anderson*, 881 P.2d 29 (N.M. 1994), unlike the Sixth Circuit in *United States v. Bonds*, 12 F.3d 540 (6th Cir. 1993), was more willing to consider the importance and impact of the NRC Report on the viability of the defendant's conviction.

³⁴846 P.2d at 505 n.2. Like the Supreme Court of New Hampshire in *State v. Vandebogart*, the Washington court focused its *Frye* analysis only on (1) whether the theory of the DNA forensic testing is generally accepted and can produce reliable results, and (2) whether the technique of forensic DNA testing is generally accepted in the scientific community.

³⁵846 P.2d at 511, citing Thompson & Ford, *DNA Typing: Acceptance and Weight of the New Genetic Identification Tests*, 75 Va L Rev 45, 93-95; and Hoeffel, Note, *The Dark Side of DNA Profiling: Unreliable Scientific Evidence Meets the Criminal Defendant*, 42 Stan L Rev 465, 493 (1989-90).

What the court did become troubled over, nonetheless, was the statistical evidence that the prosecution wished to introduce into its case. The defendant challenged the evidence on two fronts: first, whether testimony that the DNA taken from the crime scene matched the DNA taken from the defendant; and second, whether the statistical evidence presented at the hearing was invalid.³⁶

The court discussed each of these challenges thoroughly. Correctly, it noted that the probes used in RFLP must actually detect sites that are polymorphic (variable in individuals) and not monomorphic (the same in all individuals), or else the concept of “match” means nothing. For example, if the probes were detecting the genes for legs, eyes, arms, and mouth, all DNA tests would match, as if they came from the same person.

Additionally, once the polymorphic aspect of the DNA is established, then the proponent of the evidence must establish that the alleles tested are each independent. That is, that there is no relationship among the various alleles (such as hair color and eye color, which are not independent genes). This issue, referred to as the “linkage equilibrium” problem, proved to the court to be a difficult issue.³⁷ “It has not been sufficiently established that the various probes used detect independent alleles. Various scientists have raised concerns that the databases used do not adequately address the problem of population substructures.”³⁸

The other problem found by the court was the “Hardy-Weinberg equilibrium” assumption—that statistical calculations are based on a truly random population which mates randomly and mixes the gene pool evenly.³⁹ The court noted that “[o]ur decision rests on the existence of a controversy, not on its resolution.”⁴⁰ In so noting, the court quoted from NRC Report:

Substantial controversy has arisen concerning the methods for estimating the population frequencies of specific DNA typing patterns. Questions have been raised about the adequacy of

³⁶846 P.2d at 512.

³⁷This problem is discussed at length at § 11:27.

³⁸846 P.2d at 513.

³⁹This concept is discussed at length at § 11:28, *supra*.

⁴⁰*Id.* at 514.

the population databases on which frequency estimates are based and about the role of racial and ethnic origin in frequency estimation.⁴¹

In addressing these concerns, the *Cauthron* court quoted from various scientific publications which confirmed the existence of such problems,⁴² and cited a variety of legal publications also reflecting such concerns.⁴³

In the case at issue, the expert had not used any probability statistics. Rather, the prosecution experts testified that the defendant's DNA "matched" the semen samples taken from the victims and that the DNA could not have come from anyone else on earth.

The *Cauthron* court disapproved of such testimony, stating that to permit the expert to testify about a match without explaining what that means is a meaningless exercise. This is also the view taken by the Massachusetts court in the *Curnin*⁴⁴ case, the Alabama Court in *Perry v. State*,⁴⁵ the California court in *People v. Barney*,⁴⁶ the Oklahoma court in *Taylor v. State*,⁴⁷ and the NRC Report. "Testimony of a match in DNA samples, without the statistical background or probability estimates, is neither based on a generally accepted scientific theory nor helpful to the trier of fact."⁴⁸

The court then held that it was dissatisfied by the Cellmark handling of the evidence, especially with regard to

⁴¹Id. at 514, quoting from the NRC Report at 74-75.

⁴²See, e.g., Eric S. Lander, Population Genetic Considerations in the Forensic Use of DNA Typing, 32 Banbury Report: DNA Technology and Forensic Science 143 (Jack Ballantyne et al, eds 1989); Lewontin & Hartl, Population Genetics in Forensic DNA Typing, 254 Science 1745 (1991). Lander has since changed his position, see Lander & Budowle, DNA Fingerprinting Dispute Laid to Rest, Nature, Oct 27, 1994, at 735, discussed supra at § 11:34.

⁴³The articles cited were: Lempert, Some Caveats Concerning DNA as Criminal Identification Evidence: With Thanks to the Revered Bayes, 13 Cardozo L Rev 303 (1992); Saks & Koehler, What DNA "Fingerprinting" Can Teach the Law About the Rest of Forensic Science, 13 Cardozo L Rev 361 (1991).

⁴⁴Commonwealth v. Curnin, 565 N.E.2d 440 (Mass. 1991).

⁴⁵Perry v. State, 586 So. 2d 242 (Ala. 1991).

⁴⁶People v. Barney, 10 Cal. Rptr. 2d 731, 745 (Cal. App. 1992). But see People v. Venegas, 954 P.2d 525 (Cal. 1998).

⁴⁷Taylor v. State, 889 P.2d 319, 337 (Okla. Crim. App. 1995).

⁴⁸846 P.2d at 516.

the statistical database. Citing the recommendations that had been made by the NRC Report with regard to collecting databases, and for estimating population frequencies, the court reversed the defendant's conviction. On remand, the court instructed the trial court to "take additional expert testimony to determine if the empirical evidence utilized by Cellmark is valid under the criteria set for by the Committee⁴⁹ prior to allowing an expert to testify about the results."⁵⁰

Thus, the court's holding is that "RFLP testing is admissible. However, we conclude that it was error to admit the testimony of a 'match' since it was not accompanied by valid probability statistics."⁵¹

The State of Connecticut reversed a conviction based in part on DNA evidence in the recent case of *State v. Sivri*.⁵² The court there, recognizing the effect of the NRC Report, remarked that the Report had "significantly changed the scientific landscape."⁵³

In *Sivri*, the defendant was arrested for the murder of a masseuse/prostitute, whose body was never recovered, although there were large blood stains at the defendant's home and a substantial amount of evidence pointing to fatal foul play by the defendant.⁵⁴

Since the body was never recovered, the blood stains in question were compared to the blood of the victim's parents to arrive at a probability that the blood in question was someone's other than the victim.⁵⁵

According to the evidence put on by the prosecution, the Caucasian database used by Cellmark had samples from 300 people, taken from a Red Cross blood bank in Delaware. For each of the three alleles tested, the database was consulted

⁴⁹This refers to the NRC Report recommendations.

⁵⁰846 P.2d at 517.

⁵¹Id. at 518.

⁵²*State v. Sivri*, 646 A.2d 169 (Conn. 1994).

⁵³Id. at 191.

⁵⁴This case, however, is extremely troubling from a legal and factual perspective. The dissents of the Chief Justice and another Justice bear reading and highlight the difficulty in discerning between circumstantial evidence and speculation.

⁵⁵Calculating this type of probability is obviously different from calculating the probability of a match of a known DNA sample, as is typical in most cases.

to determine the probability that a match would have occurred coincidentally. Thus, six separate probabilities were created—three representing the match with the mother's DNA, three representing the match with the father's.

Next, the expert testified that using the product rule,⁵⁶ the probabilities are multiplied together for each parent. Thus, the resulting probability concerning the mother was that one in 1400 unrelated persons would have the same alleles and one in 26,000 for the father.

On defense, Dr. Laurence Mueller of the University of California at Irvine⁵⁷ testified about the problems with linkage equilibrium as well as the problems with the Cellmark database.⁵⁸

In *Sivri*, the Supreme Court of Connecticut discussed the problems of DNA that had been raised by the defense and subsequent to conviction, recognized by the NRC Report.⁵⁹ The Connecticut court also cited to the decisions of other courts, including Massachusetts,⁶⁰ Arizona,⁶¹ New Hampshire,⁶² Washington,⁶³ the District of Columbia,⁶⁴ and California.⁶⁵

Citing to the NRC Report, as well as other decisions from other jurisdictions, the court addressed three issues. First, the *Sivri* court remarked that the Report had fully endorsed

⁵⁶The product rule is explained at length § 11:24, *supra*.

⁵⁷Dr. Mueller testified repeatedly throughout the country on the issue of problems with linkage equilibrium and Hardy-Weinberg equilibrium.

⁵⁸Dr. Mueller conceded, however, that the issue of the Hardy-Weinberg equilibrium would be irrelevant in this case. 646 A.2d at 191, n35.

⁵⁹As with other cases, such as *Bonds* and *Anderson* discussed *supra*, the NRC Report was issued after the trial court took evidence. Connecticut, like many other courts, took notice of the NRC Report in their decision. To date, the only court to disregard the NRC Report intentionally is the *Bonds* decision in the Sixth Circuit.

⁶⁰*Commonwealth v. Lanigan*, 596 N.E.2d 311 (Mass. 1992).

⁶¹*State v. Bible*, 856 P.2d 1152 (Ariz. 1993), cert. denied, 511 U.S. 1046 (1994).

⁶²*State v. Vandebogart*, 616 A.2d 483 (N.H. 1992).

⁶³*State v. Cauthron*, 846 P.2d 502, 505 (Wash. 1993), abrogated on other grounds, *State v. Copeland*, 922 P.2d 1304 (Wash. 1995).

⁶⁴*United States v. Porter*, 618 A.2d 629 (D.C. 1992).

⁶⁵*People v. Barney*, 10 Cal. Rptr. 2d 731 (Cal. App. 1992); *People v. Wallace*, 17 Cal. Rptr. 2d 721 (Cal. App. 1993).

the DNA typing technology and indicated that the scientists were uniformly in accord about the procedures.

Second, the NRC Report acknowledged that there was a “substantial controversy” concerning the methods for estimating the population frequency and that there were questions about the role of racial and ethnic origin in frequency estimation. Third, the *Sivri* court stated that the Report “recommended that courts admit into evidence population frequency calculations, but it set out various recommended criteria for the admission of this evidence, including the reliance on conservative population frequency estimates, and the use of a ceiling principle, which is a method of estimating probabilities that attempts to account for population substructures.”⁶⁶

These problems had led some courts, including Massachusetts, California and Arizona to hold that the population frequency evidence did not meet the *Frye* standard and was therefore inadmissible. Other courts, such as Washington, the District of Columbia and New Hampshire, took a less rigid view, remanding the case to permit the trial court to determine whether the ceiling principles suggested do, in fact, meet the *Frye* standard of admissibility.

Thus, the Connecticut court remanded the case to the trial court for further consideration and held that

if this issue [population substructure and the ceiling principle] again becomes relevant, the trial court should consider the conclusions and recommendations of the Committee report and any other relevant evidence, including expert testimony, and determine whether the probability calculations sought to be introduced conform to the criteria set out in the Committee report, or if not, whether the evidence nevertheless passes appropriate scientific evidence standards under the circumstances of this case.⁶⁷

As mentioned in the analysis of the *Sivri* case, there are other jurisdictions that have remanded the case to the trial court for consideration.

One of those cases was *State v. Vandebogart*,⁶⁸ in which the Supreme Court of New Hampshire elected to keep a two-prong *Frye* test. The court noted that although many had

⁶⁶646 A.2d at 192.

⁶⁷*Id.*

⁶⁸*State v. Vandebogart*, 616 A.2d 483 (N.H. 1992).

criticized *Frye*, there were legitimate reasons to adhere to such a test. First, it “permits disputes concerning scientific validity to be resolved by the relevant scientific community,” second, it “ensures that a minimal reserve of experts exist who can critically examine the validity of a scientific determination in a particular case,” and third it “spares courts from the time-consuming and difficult task of repeatedly assessing the validity of innovative scientific techniques” and fourth, it “promotes a degree of uniformity of decision.”⁶⁹

Like the Supreme Court of Washington in *Cauthron*, discussed above, New Hampshire likewise conducted a review de novo of the novel scientific evidence in the case. “Whether a scientific theory and the technique used to implement it are generally accepted does not vary according to the circumstances of each case, and thus the determination of general acceptance is not a matter to be left to each trial judge’s individual discretion.”⁷⁰

The court in New Hampshire, like all other jurisdictions, found that the DNA profiling theory and procedures for declaring a match were generally accepted as reliable. Citing the NRC Report, however, the court determined that there was no general acceptance of the population frequency calculation. It stated that the “most important question underlying the validity of using the product rule is whether significant population substructure exists.”⁷¹

The court determined that, given the conflicting expert testimony at the *Frye* hearing as well as the NRC’s recognition of the debate, the evidence concerning population frequency did not meet the general acceptance standard: “We conclude that the FBI’s method for estimating population frequencies, which relies on the product rule, has not found general acceptance in the field of population genetics.”⁷²

Because the New Hampshire court considered a match without statistical evidence “meaningless,” it found that evidence of a match would not be admissible unless accompanied by a population frequency estimate that has been produced from a generally accepted method.

⁶⁹Id. at 489, citing a variety of state and federal opinions.

⁷⁰616 A.2d at 491, citing *Reed v. State*, 391 A.2d 364 (Md. 1978).

⁷¹616 A.2d at 493.

⁷²Id.

The *Vandebogart* court did discuss the recognition of the ceiling principle in DNA testing and, on remand, suggested that the State may be able to demonstrate that there is general acceptance of that principle which would permit the admission of DNA testimony.

There are other cases that have disallowed DNA testing, although they have not received as much attention as have those discussed above. One is the Nebraska Supreme Court case of *State v. Houser*.⁷³ In that case, the court found that the State did not produce evidence establishing that Lifecodes Laboratory had appropriate written protocol or that the proper protocol had been followed in the instant case. Additionally, the court found that there was insufficient evidence in the trial court to establish the accuracy of the probability testimony in question.

Finally, the trial court's failure to weigh the probability value against any prejudicial effect further contributed to error. The defendant's conviction was reversed and the case was remanded.

§ 11:57 Jurisdictions disallowing or limiting DNA evidence—Post-1996 NRC II Report cases: toward uniform admissibility of DNA evidence

The science of DNA fingerprinting changes rapidly. As the science has changed, so have the courts' decisions on whether to admit expert testimony. Following the 1992 NRC Report, a number of courts embraced the ceiling principle and modified ceiling principle recommended by the Report. Since that time, however, scientists appear to have reached agreement that the product rule provides a more accurate analysis and that there is no need to use the ceiling principle.

Following the publication of the 1992 Report, the National Research Council formed a new committee to update and clarify principles concerning population genetics and statistics as used with DNA evidence. According to the 1996 Report, it is not necessary to apply the ceiling principle or modified ceiling principle: "The abundance of data in different ethnic groups within the major races and the genetically and statistically sound methods recommended in this report

⁷³*State v. Houser*, 490 N.W.2d 168 (Neb. 1992).

imply that the ceiling principle and the interim ceiling principle are unnecessary.”¹

This change in position has been recognized by a number of Courts across the country and will likely become even more widespread barring another change in the science.²

In *State v. Copeland*,³ the Supreme Court of Washington, sitting en banc, revisited the issue of the admissibility of DNA evidence. This time, unlike its holding in *State v. Cauthron*,⁴ the Washington Supreme Court did not require the proponent of DNA evidence to use the modified ceiling principle. In its lengthy and well-reasoned opinion, the court held that there was no reason to continue to require use of the modified ceiling principle. The court stated:

Although at one time a significant dispute existed among qualified scientists [concerning the product rule], from the present vantage point we are able to say that the significant dispute was short-lived. *Cauthron* was decided while the dispute raged; since that time additional empirical studies have been conducted, the FBI has collected data from around the world, and one of the most vociferous opponents of use of the product rule has joined with an FBI scientist in declaring that the DNA wars are over.⁵

Since scientists are in general agreement about the acceptability of the product rule in the use of DNA evidence, it is likely that the vast majority of courts will soon follow the lead of the scientists.

In March, 1998, the Supreme Court of Arizona, sitting *en*

[Section 11:57]

¹National Research Council, Committee on DNA Forensic Science: An Update, the Evaluation of Forensic DNA Evidence, 162 (1996).

²See, e.g., *State v. Johnson*, 922 P.2d 294 (Ariz. 1996). See also *People v. Soto*, 981 P.2d 958, 976 (Cal. 1999) (upholding the use of the unmodified product rule and collecting cases from various jurisdictions in agreement); *Clark v. State*, 679 So. 2d 321 (Fla. App. 1996); *People v. Dalcollo*, 669 N.E.2d 378 (Ill. App. 1996), appeal denied, 675 N.E.2d 635 (Ill. 1996); *State v. Kinder*, 942 S.W.2d 313 (Mo. 1996), cert. denied, 118 S. Ct. 149 (1997); *State v. Marcus*, 683 A.2d 221 (N.J. Super. 1996); *Commonwealth v. Blasioli*, 713 A.2d 1117 (Pa. 1998)(citing this Treatise); *State v. Morel*, 676 A.2d 1347, 1353 (R.I. 1996); and *State v. Jones*, 922 P.2d 806 (Wash. 1996).

³*State v. Copeland*, 922 P.2d 1304 (Wash. 1996).

⁴*State v. Cauthron*, 846 P.2d 502 (Wash. 1993).

⁵*Copeland*, 922 P.2d at 1318.

banc, decided that PCR testing was admissible, after finding that it met the *Frye* standard of scientific admissibility.⁶ The court noted that both other states had approved the use of PCR testing and stated that “[t]he overwhelming consensus among scientists is that so long as proper procedures are followed, the results should be reliable.”⁷ Arizona is not alone in its acceptance of either the PCR method of testing DNA or the admissibility of DNA evidence without use of the ceiling principles. In *State v. Stills*,⁸ the Supreme Court of New Mexico approved of the method in 1998, quoting a commentator who stated that “PCR analysis has received overwhelming acceptance in the scientific community and the courts.”⁹ A number of courts, both state and federal, have held PCR evidence admissible.¹⁰

⁶State v. Tankersley, 956 P.2d 486 (Ariz. 1998).

⁷Id. at 492, citing the 1996 NRC Report at 23 and the 1992 NRC Report at 145-46.

⁸State v. Stills, 957 P.2d 51 (N.M. 1998).

⁹Id. at 57, quoting George Bundy Smith & Janet A. Gordon, The Admission of DNA Evidence in State and Federal Court, 65 Fordham L Rev 2465, 2470 (1997).

¹⁰See, e.g., State v. Burke, 2000 ND 25, 606 N.W.2d 108 (N.D. 2000); Brodine v. State, 936 P.2d 545 (Alaska App. 1997); State v. Butterfield, 2001 UT 59, 2001 WL 765821 *9 (Utah 2001); Campbell v. State, 910 S.W.2d 475 (Tex. Crim. App. 1995); State v. Isley, 936 P.2d 275 (Kan. 1997); People v. Pope, 672 N.E.2d 1321 (Ill. App. 1997), appeal denied, 677 N.E.2d 970 (Ill. 1997); Com. v. Rosier, 425 Mass. 807, 685 N.E.2d 739 (1997); Bolin v. State, 960 P.2d 784 (Nev. 1998), cert. denied, 525 U.S. 1179 (1999); State v. Harvey, 699 A.2d 596 (N.J. 1997); Commonwealth v. Blasioli, 713 A.2d 1117 (Pa. 1998) (citing this treatise); State v. Begley, 956 S.W.2d 471 (Tenn. 1997); State v. Russell, 882 P.2d 747 (Wash. 1995), cert. denied, 514 U.S. 1129 (1995); United States v. Beasley, 102 F.3d 1440 (8th Cir. 1996), cert. denied, 117 S. Ct. 1856 (1997); United States v. Hicks, 103 F.3d 837 (9th Cir. 1996), cert. denied, 117 S. Ct. 1483 (1997); United States v. Lowe, 954 F. Supp 401 (D. Mass 1990), aff’d on that ground, 145 F.3d 45 (1st Cir. 1998), cert. denied, 119 S. Ct. 270 (1998) (the district court opinion provides an extensive overview of judicial decisions recognizing RFLP, PCR, and DQ Alpha testing as reliable and generally accepted within the scientific community); State v. Brown, 949 S.W.2d 639, 641 (Mo. Ct. App. E.D. 1997); State v. Kinder, 942 S.W.2d 313, 326-28 (Mo. 1996)(en banc). United States v. Gaines, 979 F. Supp. 1429 (S.D. Fla. 1997); People v. Wright, 72 Cal. Rptr. 2d 246 (Cal. App. 1998)(review denied); Ingram v. State, 699 N.E.2d 261 (Ind. 1998); Watts v. State, 1999 WL 33867 (Miss. 1999); State v. Jackson, 582 N.W.2d 317 (Neb. 1998); State v. Roberts, 142 Wash. 2d 471, 14 P.3d 713 (2000); State

The Supreme Court of Colorado, sitting en banc, issued an important decision discussing the admissibility of PCR testing in *People v. Shreck*.¹¹ The defendant in *Shreck* was charged with sexual assault and other offenses and filed a motion to exclude certain DNA evidence, which was granted by the trial court. The Supreme Court of Colorado, at the prosecution's request, granted an interlocutory appeal. In this case, the DNA was tested using the PCR method of amplification and the short tandem repeats ("STR") method, which reveals length difference between chromosomes on different people with the same base pair sequence.¹² The court stated that "[t]here are thirteen locations at which the number of STRs are known to vary from person to person. Thus, if all thirteen locations of the known and questioned sample are identical, a match is considered to be made."¹³

The Supreme Court held that this form of PCR testing, using STRs, to be reliable and admissible. The court also found that the "multiplex" system of testing, which tests several loci simultaneously, was also sufficiently reliable to warrant such admission.¹⁴

In 2001, the Supreme Court of Washington, sitting en banc, decided that the PCR technique was reliable and properly admissible, where the tests involved the DQ-alpha, polymarker, and D1S80 systems.¹⁵ In making this decision, the court concluded that a *Frye* hearing on the admissibility of these systems was unnecessary, since such systems were not substantially different from the DQ-alpha test (which

v. Stills, 957 P.2d 51 (N.M. 1998); Wood v. State, 1998 OK CR 19, 959 P.2d 1, 11 (Okla. Crim. App. 1998); Wood v. State, 959 P.2d 1 (Okla. App. 1998); State v. Lyons, 924 P.2d 802 (Or. 1996).

¹¹People v. Shreck, 22 P.3d 68, 90 A.L.R.5th 765 (Colo. 2001). This decision is also important in that it changed the standard of admissibility for scientific evidence. See Chapters One and Ten, discussing this issue.

¹²Id. at 71.

¹³Id.

¹⁴Id. at 80. For further reading on multiplex systems, see JOHN M. BUTLER, FORENSIC DNA TYPING, 61-62 (Academic Press, 2001).

¹⁵See State v. Gore, 143 Wash. 2d 288, 21 P.3d 262 (2001). The Washington Supreme Court has approved of the use of PCR testing of DNA. See State v. Roberts, 142 Wash. 2d 471, 14 P.3d 713, 741 (2000); State v. Gentry, 125 Wash. 2d 570, 888 P.2d 1105 (1995); and State v. Russell, 125 Wash. 2d 24, 882 P.2d 747 (1994).

was accepted by the Washington Court in 1994¹⁶) and were generally accepted in the field.¹⁷ For example, the polymarker system, one witness testified, was the “identical methodology” to DQ-alpha, but tests six different genes instead of one.¹⁸ Testing which uses the D1S80 locus involves acceptable techniques of PCR (amplification) and RFLP (using gels and an electric current). The court noted that these testing techniques (amplification and the use of gels with electric currents to produce bands) are widely accepted and have been held admissible in numerous Washington cases.¹⁹

The *Gore* court also determined, in keeping with most other jurisdictions, that the product rule for calculating probabilities of a random match of a genetic profile in the human population was generally accepted in the scientific community and was admissible when using PCR-based systems.²⁰

Several courts have also followed the NRC II report and have eliminated the use of the any ceiling principles, deciding that the product rule provides a proper basis for statistical analysis.²¹

§ 11:58 Statutory guidance

Since 1990, a number of states have enacted statutes governing the admissibility of DNA evidence, and it is likely that more states will follow.

Virginia enacted a statute in 1990 providing that DNA testing “shall be deemed to be a reliable scientific technique

¹⁶See *State v. Russell*, 125 Wash. 2d 24, 882 P.2d 747 (1994).

¹⁷*Gore*, 21 P.3d at 272.

¹⁸*Id.*

¹⁹*Id.* at 272-73.

²⁰*Id.* at 275.

²¹*State v. Gore*, 143 Wash. 2d 288, 21 P.3d 262 (2001); *People v. Pope*, 672 N.E.2d 1321 (Ill. App. 1996), appeal denied, 677 N.E.2d 970 (Ill. 1997); *Armstead v. State*, 673 A.2d 221 (Md. 1996); *Com. v. Rosier*, 425 Mass. 807, 685 N.E.2d 739 (1997); *State v. Kinder*, 942 S.W.2d 313 (Mo. 1997), cert. denied, 118 S. Ct. 149 (1997); *People v. Freeman*, 571 N.W.2d 276 (Neb. 1997); *Bolin v. State*, 960 P.2d 784 (Nev. 1998), cert. denied, 525 U.S. 1179 (1999); *State v. Harvey*, 699 A.2d 596 (N.J. 1997); *Commonwealth v. Blasioli*, 713 A.2d 1117 (Pa. 1998)(citing this treatise); *Hepner v. State*, 966 S.W.2d 153 (Tex. App. 1998) (holding the admission of random match probability harmless); *State v. Copeland*, 922 P.2d 1304 (Wash. 1996). The California Supreme Court, in *People v. Soto*, 981 P.2d 958 (Cal. 1999), recently upheld the use of the unmodified product rule.

and the evidence of a DNA profile comparison may be admitted to prove or disprove the identity of any person.”¹ This statute was upheld against constitutional challenges in *Satcher v. Commonwealth*.²

Maryland³ followed suit by enacting a similar statute in 1991, as did Minnesota,⁴ Washington,⁵ and Louisiana⁶ in 1992.

In the last few years, more states have also enacted DNA legislation, in order to simplify the process of admission of such testimony into court.⁷

IV. SOME CRITICAL THOUGHTS ON DNA EVIDENCE

§ 11:59 New technology; new questions

Forensic DNA evidence relies upon a combination of modern science and technology, with new insights creating new methods. Along with this rapid development, however, comes the risk of new questions concerning the validity of both the scientific method and the technical methodology.

One newer development in forensic DNA has been the use of automated equipment to analyze short tandem repeats (STRs).¹ However, when this new methodology has been chal-

[Section 11:58]

¹Va Code § 19.2-270.5.

²*Satcher v. Commonwealth*, 421 S.E.2d 821 (Va. 1992), cert. denied, 507 U.S. 733 (1993), rev'd in part on other grounds, *Satcher v. Pruett*, 126 F.3d 561 (4th Cir. 1997).

³Md Cts & Jud Proc Code § 10-915.

⁴Minn Stat §§ 634.25, 634.26.

⁵Wash Rev Code §§ 43.43.752 through 43.43.758.

⁶La Rev Stat § 15:441.1.

⁷Alabama, Code of Ala § 36-18-30; Alaska, Alaska Stat § 12.45.035; Connecticut, Conn Gen Stat § 54-86k; Delaware, 29 Del C § 4713; Idaho, Id St § 19-5505; Indiana, Ind Stat § 35-37-4-13; Louisiana, La Rev Stat 15:441.1; Maryland, Md Cts & Jud Proc Code Ann § 10-915; Minnesota, Minn Stat §§ 634.25, 634.26; North Dakota, ND Cent Code, § 31-13-02; 22; Oklahoma, Okla Stat § 751.1; Tennessee, Tenn Code Ann § 24-7-117; Virginia, Va St § 19.2-270.5.

[Section 11:59]

¹See <<http://www.scientific.org/news-notes/news/html>>, discussing the issue.

lenged, a few trial courts have not admitted the evidence.² The Supreme Court of Colorado, however, has approved of such technology.³ While this issue is still to be addressed by appellate courts, it illuminates a significant concern about technologically driven scientific evidence — namely, methodological validity must be proved, not assumed.

The following sections present a candid discussion of the issues that raise concerns in DNA litigation.

§ 11:60 New technology; new questions—Financial interests of DNA experts

The legal community is entirely dependent in DNA cases upon a small group of experts, many of whom have an enormous amount of money or personal interest at stake.

The laboratories that have brought us forensic DNA testing, such as Lifecodes and Cellmark, have a huge financial stake in the viability of DNA testing. The motives of their employees, therefore, to support the science cannot be entirely academic and pure. Their future employment and livelihood depends on the acceptance of the science in the courtroom. Understandably then, the “impartiality” we would hope for in experts is lacking. While no one is suggesting that these scientists are falsifying information or changing results, there is a need to look critically at the messenger in these cases, and not just the message.

Second, the FBI is another of the large laboratories currently pushing hard for the admission of its evidence. Yet, even more so than the commercial laboratories, the FBI is actually a party in interest. Consider for a moment if a commercial laboratory were the expert in a case of a novel scientific theory in which it was also a party. Most judges would have difficulty accepting the testimony of such experts, without being overly affected by the bias issue.

Yet, in DNA cases, the FBI has been both a party and the laboratory trying to convince the court that their methods

²See opinions found at <<http://www.scientific.org/news-notes/news/html>>.

³*People v. Shreck*, 22 P.3d 68, 90 A.L.R.5th 765 (Colo. 2001). Other state courts have likewise approved of the use of the multiplex systems, which test multiple loci at one time. See *State v. Butterfield*, 2001 UT 59, 2001 WL 765821 (Utah 2001).

are worthy of scientific acceptance. Not one court to date has remarked on the fact that the government is sponsoring both the prosecution and the expert testimony to establish such evidence as acceptable to the courts. Given the allegations that the Government is attempting to strong-arm those scientists in disagreement with the official FBI position,¹ the courts need to be taking a stronger, more involved role in the direction that this jurisprudence takes.

§ 11:61 [Reserved]

§ 11:62 New technology; new questions—Trial by mathematical probability

Are we creating trial by mathematical probability when we allow figures like “one in a billion” into evidence?

Some have raised concerns about the appropriateness of using both statistical probability as evidence of crime and using overwhelming statistical evidence to identify and convict defendants. The courts¹ as well as commentators have long wrestled with the issue of the appropriate use of statistical evidence in trials.²

In some recent cases, the only evidence to link the defen-

[Section 11:60]

¹See Neufeld, Have You No Sense of Decency?, 84 J Crim L & Criminology 189 (1993).

[Section 11:62]

¹The most well-known case discussing the use of the product rule as well as Bayesian analysis is *People v. Collins*, 68 Cal. 2d 319, 66 Cal. Rptr. 497, 438 P.2d 33, 36 A.L.R.3d 1176 (1968), a case referenced in most evidence courses and in dozens, if not hundreds of law review articles. In a contemporary case, the Court of Special Appeals of Maryland discussed the use of the product rule in a case involving the likelihood of more than one child in a family dying of Sudden Infant Death Syndrome (SIDS). See *Wilson v. State*, 136 Md. App. 27, 764 A.2d 284 (2000), cert. granted, 363 Md. 662, 770 A.2d 169 (2001), cert. denied, 770 A.2d 169 (Md. 2000).

²Among the original widely-referenced articles are Michael O. Finkelstein & William B. Fairley, A Bayesian Approach to Identification Evidence, 83 Harv. L. Rev. 489 (1970); Laurence H. Tribe, Trial by Mathematics: Precision and Ritual in the Legal Process, 84 Harv. L. Rev. 1329, 1344-50 (1971); Michael O. Finkelstein & William B. Fairley, The Continuing Debate over Mathematics in the Law of Evidence: A Comment on “Trial by Mathematics,” 84 Harv. L. Rev. 1801 (1971); and Laurence H. Tribe, A Further Critique of Mathematical Proof, 84 Harv. L. Rev. 1810 (1971). More contemporary articles include Jonathan J. Koehler & Daniel

dant to the crime has been DNA evidence, which courts have held to be sufficient evidence of guilt.³ In 2000, the Supreme Court of Arkansas upheld a conviction that was based primarily on DNA evidence, stating:

This court is, therefore, satisfied that the testimony of even one DNA expert that there is a genetic match between the semen recovered from the victim of a rape and the blood of the defendant, a total stranger, and the statistical probability that anyone else was the source of that semen are 1 in 500 million is legally sufficient to support a guilty verdict.⁴

There is little doubt that juries and courts are satisfied that the testimony of one eyewitness is sufficient evidence to convict—even when the parties are strangers, the lighting is poor, and the identification is cross-racial.⁵ Yet, many are troubled by technical evidence resting on mathematical probability.

As our forensic capability becomes more discerning and more prevalent in the court, the issue of the appropriate use of statistical probability becomes more focused.

§ 11:63 New technology; new questions—Establishing protocol

What kind of protocols should there be for DNA testing and who should oversee the process?

One of the suggestions of the NRC Report is to create a standardized method to govern the protocol of the laborator-

N. Shavero, Veridical Verdicts: Increasing Verdict Accuracy Through the Use of Overtly Probabilistic Evidence and Methods, 75 Cornell L. Rev. 247, 274-75 (1990); Robert S. Thompson, Decision, Disciplined Inferences and the Adversary Process, 13 Cardozo L. Rev. 725 (1991); and Robert Timothy Reagan, Supreme Court Decisions and Probability Theory: Getting the Analysis Right, 77 U. Det. Mercy L. Rev. 835 (2000).

³See, e.g., *People v. Soto*, 39 Cal. Rptr. 2d 406, 890 P.2d 1115 (Cal. 1995), *aff'd*, 21 Cal. 4th 512, 88 Cal. Rptr. 2d 34, 981 P.2d 958 (1999); *People v. Rush*, 165 Misc. 2d 821, 630 N.Y.S.2d 631 (Sup 1995), judgment *aff'd*, 242 A.D.2d 108, 672 N.Y.S.2d 362 (2d Dep't 1998); *Springfield v. State*, 860 P.2d 435 (Wyo. 1993).

⁴*Roberson v. State*, 16 S.W.3d 156, 170 (Tex. App. Austin 2000), petition for discretionary review refused, (Sept. 13, 2000).

⁵All of these factors affect the reliability of eyewitness identification. For more on the problems associated with eyewitness identification, see §§ 13:54 -13:56.

ies using DNA testing. There needs to be standards and such standards need to be rigorously applied.¹

The major issue with protocol standards and standardization is acknowledging that in a process this novel and radical, the courts should not be a testing grounds for discovering what is right with the process and what is wrong. Rather, uniformity and standardization in the process are absolutely necessary to maintain the certainty of the science.

§ 11:64 [Reserved]

V. GUIDES AND CHECKLISTS

§ 11:65 Prosecutor's guide to DNA evidence

If you are a prosecutor and you intend to use DNA evidence, you will have by far the easier job in using such evidence than will defense counsel. Because there is a great deal of help available to the prosecution on this subject and because the greatest difficulty with DNA evidence is in the challenge to its use, the following sections need provide only a brief analysis.

If you have a case in which the DNA at the crime scene appears to match the accused's DNA sample and your jurisdiction permits the introduction of DNA evidence, the following sections detail the issues you will need to address in consultation with your expert.

§ 11:66 Prosecutor's guide to DNA evidence—Make certain the expert confirms the match

Always check with your expert to make certain that there is no hesitancy or vacillation about whether the control sample matches the crime scene sample. In the event there is a problem with the match, you would do better to go without the DNA testimony than to have your case blow up before the jury and possibly be destroyed.

Additionally, check with your expert about how the expert will be able to withstand a challenge to the conclusion of a

[Section 11:63]

¹The need for standardizations and controls in all forensic laboratories is truly an issue for those involved with forensic evidence. This issue is discussed at length in Chapter 12.

match. If the expert is hard pressed to provide you with an appropriate explanation, you can imagine how poorly a jury will receive such an inadequate response.

**§ 11:67 Prosecutor's guide to DNA evidence—
Establish proper protocol**

Can your expert articulate the appropriate procedures for DNA testing and testify that they were followed in this case? If not, the expert's conclusion concerning the match may be put into question. It is beyond question that the proper protocol is an essential element of establishing your case in DNA testing.

In some jurisdictions, for example, it is the prosecution's burden to establish that proper procedures were followed in the case. Thus, a failure to establish appropriate methods in the case at bar may result in the evidence being excluded.

In the event the evidence survives exclusion, but problems exist with the protocol, the defense will have an opportunity to exploit those weaknesses on cross-examination so as to convince the jury that the evidence is not worth the paper it is blotted upon.

**§ 11:68 Prosecutor's guide to DNA evidence—Keep
the explanation simple**

One time while writing this book I found myself explaining linkage equilibrium to non-lawyers at a dinner party. The blank stares I was getting finally brought me back to reality, where I became aware that I had lost my audience.¹ Although a dinner party is not a courtroom, the same principle applies: If the subject is technical and boring, people tune out quickly. When your witness is explaining DNA evidence, make sure that the explanations are simple, short and to the point.

Additionally important is the use of "toys" for the jury during the explanation. The most helpful tools to use are models of DNA that can be taken apart, as well as color diagrams and charts to help explain such issues as the modified ceiling principle.

[Section 11:68]

¹Not to mention that I had lost my mind if I really thought discussing DNA at a dinner party was "having a good time."

Whatever you do, avoid boring your jury to death with explanations that are too technical. On the other hand, do not make your explanation so simplistic that you will be unable to prove the elements of your case. Understandably, it is a fine line dividing simple from simplistic. For that reason, a written direct examination, reviewed ahead of time with your witness is particularly important for this type of evidence.

§ 11:69 Prosecutor's guide to DNA evidence—Know the law and keep the testimony within its limits

As with every other subject in the law, failure to know the law in your jurisdiction may result in total failure in the courtroom. The law on DNA testing has been in constant flux since 1991. Do not assume that you know the law in your jurisdiction until you have reviewed this chapter (many jurisdictions are included) and have updated the research to check for the most recent developments. Once you are comfortable with the state of the law, then you are able to structure the testimony in accordance with those limits.

§ 11:70 Prosecutor's guide to DNA evidence—Who should be an expert

In many forensic cases, experts are often the technicians who perform the testing to obtain the results. As a rule of thumb in DNA cases, try to use experts who have been qualified as such in prior cases. There are people who testify frequently on DNA and your case will most likely proceed more smoothly with those experts.

Also, if the defense is going to present expert testimony, you will need to make sure that your expert's qualifications do not pale in comparison to the opposition's experts. Be careful not to let your expert be outdone by a better qualified expert.

§ 11:71 Defense lawyer's guide to using DNA

Unless you are using DNA evidence to exculpate your client—a task that should not prove overly burdensome—DNA evidence poses a much bigger challenge for defense lawyers. For that reason, the defense lawyer's guide is somewhat more in depth than the prosecutor's guide.

In the event you are challenging DNA evidence that indicates that the forensic sample matches the DNA sample found at a crime scene, the following sections provide a guide for you to follow.

**§ 11:72 Defense lawyer's guide to using DNA—
Organize a strategy**

In order to focus on how to use DNA evidence, the following hypothetical will suggest a typical set of facts that you could confront in a DNA case.

Assume that the following circumstantial evidence links your married, male client with the married, female victim who has been murdered: they worked together, some people at work thought they were having an affair, and she was stabbed with a knife that is consistent with a hunting knife owned by the defendant (although without any evidence of blood on it). The time of death is between 8:00 and 10:00 p.m. on a Sunday night, during which time your client claimed to be at a movie by himself. In addition, there is DNA evidence which could come into evidence to establish that a small spot of blood found on your client's pant leg matches the blood of the victim, according to DNA profiles. Finally, there is evidence to suggest that (under the modified ceiling principle), the chances of such a match are one out of 85,000.

There are several possible defenses that could be available, including the most obvious choices of: (1) claiming the blood is from someone other than the victim; or (2) claiming the blood may be from the victim, but that it may have come from a minor cut she received at work.

However, how you choose to mount a defense will affect whether and how you are challenging the evidence. One of the factors in your decision making will obviously be how overwhelming the odds of the match are. For instance, if your client is from a small rural location in Iowa, the number one out of 85,000 will have a different impact than if your client is a resident of New York City, where there are nine million residents and therefore numerous other possible assailants within walking distance.

Additional considerations to use in the planning of your strategy include determining (with an expert's assistance) how good the DNA match really appears, how good do you

anticipate the expert to be, and how vulnerable is the laboratory's protocol to challenge.

Finally, perhaps you believe that an error was made and that the DNA found on the pants really does not match the victim's blood at all. What to do? Is there any way to have another test performed? Can you have another expert review all the data that the prosecutors' experts have? What other ways are there to challenge the test results?

In any event, before you decide how to handle the DNA evidence, make sure you have put it into the context of the entire case.

§ 11:73 Defense lawyer's guide to using DNA—Know the law in the jurisdiction

If you have read any of Part 1 of this treatise, you have heard repeatedly how important it is to know the state of the law in your jurisdiction. Although this book includes the law for the vast majority of states, as stated earlier, the law on DNA admissibility has been in a state of constant flux.

Thus, make sure you review the law in this chapter as well as doing an electronic research check to make sure you have not missed any new case that has been decided since the time of this publication.

§ 11:74 Defense lawyer's guide to using DNA—Take the time to learn the science

Without question, the science of DNA testing is difficult to grasp and is not the most scintillating issue with which you have ever had to become conversant. Nevertheless, there is no substitute for teaching yourself everything you need to know about the subject, both with the help of this chapter as well as the source materials cited. The NRC Reports are written in clear and accessible language and should help in those areas where the subject is not well understood.

Additionally, there are other lawyers who have a well-developed knowledge of DNA testing who may be willing to help you out should you have a case involving DNA evidence.

Finally, discuss the DNA issues in your case with an expert, who should be able to explain the confusing aspects of the case to you. Do not neglect to read any of the latest studies on DNA that are written for the lay person. A good place to start is *Judicature* or the *National Law Journal*,

which generally will contain pertinent discussions.

**§ 11:75 Defense lawyer's guide to using DNA—
Determine whether you need an expert**

Having determined the strategy of your case, the question of whether you will need to hire an expert becomes much clearer. In the event you are directly challenging either the admissibility of the evidence and/or the accuracy of the evidence in your case, you will absolutely need to hire at least one expert, if not several.

However, (using the hypothetical above) if you are admitting that the blood in question may be the victim's, you may not need an expert at all. The questions that need to be answered include the following:

- Is there sufficient money for an expert or does your jurisdiction permit the appointment of DNA experts? Some jurisdictions have found that indigent defendants are entitled to DNA experts¹ while other jurisdictions have disagreed.²
- How significant is DNA in your case? If the blood is the crucial bit of testimony, you need to at least consult with an expert and preferably call one to testify (if the expert is able to provide helpful testimony).
- How significant are the statistics? If you are in a jurisdiction that allows the expert to opine that "the chances of a match are 1 in 2 billion" you definitely need an expert who can at least reduce the percentages to a more reasonable level.
- Is this a case in which the defendant will stand a better chance with a plea, rather than a trial? If so, perhaps the time and money is better spent on working out a better plea for the client.

[Section 11:75]

¹See, e.g., *State v. Bloom*, 516 N.W.2d 159 (Minn. 1994), providing that an indigent defendant has a right to "reasonable access to expert support at public expense." *Id.* at 169. Accord *Taylor v. State*, 889 P.2d 319 (Okla. Crim. App. 1995).

²See, e.g., *State v. Harris*, 866 S.W.2d 583 (Tenn. App. 1992).

§ 11:76 [Reserved]

**§ 11:77 Defense lawyer's guide to using DNA—
Challenging the admissibility of DNA
evidence**

You may be able to challenge the admissibility of DNA evidence in court on a few grounds. For example, the following grounds may be pursued: the prosecutor's failure to establish a match; the total contamination of the sample; or the failure of the laboratory to establish that it followed proper protocol in performing the testing.

**§ 11:78 Defense lawyer's guide to using DNA—
Deciding whether to file a motion in limine
or request a voir dire hearing**

There are a few procedural avenues available to challenge the admissibility of DNA evidence. You can file a motion in limine or request a voir dire hearing during the prosecution's case in chief.

Many defense lawyers are hesitant to file a motion in limine, since that provides the prosecution with: (1) too much notice of the defense strategy; (2) the ability to investigate and brief the issue; (3) too much time to change its witness's approach to the evidence. Nevertheless, if you are in a court that requires matters of admissibility to be raised in a motion in limine, you may be required to do so.

Another factor to consider is whether the grant of a motion in limine is appealable by the prosecution. In some jurisdictions, if the prosecution certifies that the allowance of the motion would substantially hinder or effectively end their prosecution, they may stop the case and file an interlocutory appeal on such issue.¹ In the event such an issue is raised during trial however, jeopardy would have attached, significantly limiting the prosecution's ability to do anything about the court's ruling, should it be adverse to the prosecution.

In the event you are intending to challenge the admissibility of DNA test results, you can request a voir dire hearing

[Section 11:78]

¹See *Commonwealth v. Deans*, 610 A.2d 32 (Pa. 1992).

to have the court rule on the admissibility of the evidence.² In the event you do not believe you will be successful in convincing the court to exclude the evidence, you may want to forgo the voir dire hearing and use your ammunition on cross-examination.

In taking this latter course, you will be unable to keep the evidence away from the jury (although you might be able to have the testimony stricken, if you are really lucky), but you will be able to seriously damage the prosecution's use of such evidence in front of the jury. Additionally, if you do have a voir dire hearing and lose, the prosecution and its witness are prepared for your likely cross-examination, which is generally harmful to your case.

As with many other matters at trial, it is worth planning your strategy in advance given what you know about the case, the prosecution and the court. As with other decisions about evidence, do not wait until the very last minute to analyze the situation and determine your strategy.

**§ 11:79 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert**

There is no cookbook recipe for how to cross-examine each expert on DNA. It depends entirely on what the expert has done and what the expert is able to say. However, the following sections provide a few guidelines that should help in your preparation for cross-examination.

**§ 11:80 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert—Using
the pretrial statement**

First, pursuant to most procedural¹ or evidence rules, the prosecution is generally required to provide the defense with

²See, e.g., Fed R Evid 103(c), which provides:

In jury cases, proceedings shall be conducted, to the extent practicable, so as to prevent inadmissible evidence from being suggested to the jury by any means, such as making statements or offers of proof or asking questions in the hearing of the jury.

[Section 11:80]

¹See e.g., Fed R Crim P 16(E), which provides:

At the defendant's request, the government shall disclose to the defendant a written summary of testimony the government intends to use under Rules 702, 703, or 705 of the Federal Rules of Evidence during its case in chief at trial.

a pretrial statement in response to the defense's request for an expert's opinion. Do not forget to ask for one. Generally, the report should include the name and qualifications of the expert, a list of every publication that the witness has authored and every case in which the expert was a witness, as well as a complete summary of the witness's testimony.²

That pretrial statement should be the basis of your cross-examination preparation. First, have a law student or associate review the publications to determine whether anything is possibly useful for cross-examination. The same strategy should be applied to prior testimony. Contact any of defense lawyers in the cases on the resume and find out whether there are any transcripts available on the witness.

**§ 11:81 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert—Using
your own expert to prepare**

Have your expert (assuming you have one at least to consult with) review the statement and determine where there are vulnerabilities in the expert's opinion. As discussed earlier in this chapter, it is very difficult to challenge such technical information without the benefit of an expert's opinion. Also, depending on the laboratory, there may be ways to specifically challenge that laboratory's procedures in the specific case.

**§ 11:82 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert—
Exploiting the expert's bias**

Do not overlook the importance of bias questions with DNA cross-examination. Unlike some other areas where there are

This summary must describe the witnesses' opinion, the bases and the reasons therefore, and the witnesses' qualifications.

Do not forget to file such a request in all your cases.

²One area in which criminal trial lawyers could benefit from civil trial lawyers' experience is in how to effectively limit the testimony of the expert to what is contained in the pretrial expert summary. Generally, anything that is not in the "four corners of the report" is inadmissible. In civil cases, the issue of expert's reports is often a key evidentiary matter which civil lawyers spend substantial effort focusing upon. If you are attempting to limit the testimony of an expert in your case, you may want to consider reviewing the decisions in the Federal Rules Decisions Reporter and checking in some civil trial manuals for some good strategy tips.

rather independent witnesses, the vast majority of witnesses in DNA litigation are either employed by the laboratory that performed the test or are FBI employees. Bias is a useful avenue to pursue, but really scoring points on bias occurs only if you are able to suggest that the basis of the expert's opinion is somewhat questionable. In other words, bias has less impact if the test results are solid as a rock. Thus, if you are going to use bias, it is more impressive when you are able to couple it with a good claim of bad test results.

It is rare that a jury will believe, without overwhelming evidence, that a laboratory witness will make up evidence out of whole cloth. What is more believable, however, is that in marginal test results the witness would "shade" the results to favor the laboratory.

Additionally, do not forget that most of the testing in DNA is not done "blind." Rather, the laboratory is often told what the prosecution is looking for—namely, a match with a certain forensic sample. Studies have shown that knowing the desired outcome ahead of time sometimes skews the results in that favor when matters of interpretation are at stake.

Finally, it is important to keep in mind that, if nothing else, showing that the expert has always testified for the prosecution can lead to a handful of useful questions in front of the jury, questions that may not win the case, but may put some uncertainty in the jury's mind. Also, if you can establish that the expert has always found a match when asked to, you are in a position to suggest that the expert would find a match whether one existed or not.

**§ 11:83 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert—Know
how to discuss the problems of DNA**

Before you cross-examine a DNA expert, it is always helpful to review the literature on where DNA testing can have problems. In a nutshell, the following areas are frequently the most important:

- Crime scene contamination
- Sample is too small for proper testing
- Destruction of the sample, so no control test
- The problem of shifting bands

- The possibility of false assumptions
- Hardy Weinberg equilibrium problem
- Poor quality laboratory procedures
- Database is too small

These specific issues are discussed earlier in the chapter and information about handling forensic problems is contained in Part 3.¹

**§ 11:84 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert—
Challenging the expert's
credentials/knowledge**

Throughout this treatise, repeated warnings have been given about not trying to “outsmart the expert.” Well, like all good rules, there are good exceptions. One exception is in the case where the prosecution uses a laboratory technician as an expert. If the witness does not have at least a master's degree, you may be in a position not only to hammer on the witness's lack of credentials, but also to strike a damaging blow based upon the lack of sophisticated knowledge.

Essentially, you have a great ability to challenge the expert's conclusions on the grounds that “he can test for it, but he sure does not understand it.” In other words, if you have read all the information you can on DNA and have a good expert, you may be able to outsmart the technician.

Working with your expert, you need to find a variety of authoritative treatises on genetics, DNA testing, and such ancillary fields as population genetics. It is your mission to establish, in front of the jury, that this person has no idea about the complexity of DNA testing, has no clue as to what “junk DNA” is and what might be lurking in those base pairs, cannot explain population substructure, and cannot explain why a “match” has a range of acceptable variation.¹

If you can, use the NRC Report in your examination—several courts have recognized it in their opinions—to underscore the expert's limited knowledge. As you might

[Section 11:83]

¹See §§ 11:25-11:30, *supra*, and Appendix 3C, *infra*.

[Section 11:84]

¹Many people might have trouble concluding that a match need not match, but need only be within a certain percentage point of matching.

guess, this is a very dangerous tactic if your knowledge is not solid and you are working without a net (i.e., an expert sitting next to you). Also, make sure you are not being sandbagged by the prosecution who may be using an expert short on credentials and long on actual knowledge. You need to feel your way around with the expert and make sure you are not going to get buried.

However, you can make great use of an expert's limited knowledge and underscore with the jury how important the test is and how shallow the witness's understanding of the science is. In a case where DNA is the pivotal issue, you can create reasonable doubt with such a cross-examination.

**§ 11:85 Defense lawyer's guide to using DNA—
Cross-examination of the DNA expert—Use
their expert as foundation for yours**

In conjunction with your expert, plan for your cross-examination to lay a foundation for your own expert to testify. For example, if there is a great passage from an authoritative treatise you want to use with your expert, have their expert agree that it is an authoritative text—just be sure to pick a book you are sure will give you the answer you want.

If you need to establish certain facts for your expert, try first to do it (if there is no great danger of disagreement) with the other side's expert. The reason for such a tactic is to buttress your own expert's opinion with the opinion of the opposition's expert. Thus, by the time you get to your expert's significant and differing opinion, the jury will perceive that the prosecution expert has testified in agreement with your expert all the way along the way.

**§ 11:86 Defense lawyer's guide to using DNA—What
to do with an unshakable expert**

Do not get into a battle with an unshakable expert. You will lose and your credibility will suffer. If the expert is unmovable on his or her position, shift gears and either terminate your cross-examination before the expert has another chance to explain his conclusions to the jury or move to a less dangerous topic, such as vulnerable credentials, bias or lack of testimonial experience.

§ 11:87 Defense lawyer's guide to using DNA—The safe areas to question

When in doubt, you can always ask the witness whether he or she was responsible for securing the crime scene (the answer is no) and whether he or she was responsible for making sure the blood was not contaminated or switched anywhere along the way (most likely, the answer is no).

Additionally, you can inquire about what the witness was told about the case. If he or she was told nothing, no harm done. If he or she was told something about what the prosecution wanted, you have a new area to establish bias. Furthermore, if there were any problems at the laboratory where the expert works (for example, Lifecodes failed a proficiency test in matching and was taken to task for errors in the *Castro* case, discussed at § 11:43), you can spend a long time on those problems and the deficiencies in the laboratory.

In any event, when you are doing no good for your case, sit down. Simply digging in and letting the expert be in charge is not a good strategy. All you will do is affirm the testimony in the minds of the jurors.

§ 11:88 Prosecutor's checklist

- ☐ Make sure you have a good handle on the law of admissibility in your jurisdiction before you try to use DNA evidence. Know the limits—if any—on DNA before you base your prosecution on such evidence.
- ☐ Take the time to learn the science, including its shortcomings. Do not go into court unless you are conversant with the concepts in this chapter and have sufficiently prepared to handle any attacks on the science.
- ☐ Choose your expert carefully. Do not try to proceed with DNA unless you really believe that you will be able to use the expert that you have procured. Not all experts are created equal and make sure that yours is of good quality.
- ☐ Spend enough time with your expert to polish the testimony so that it will be believable to the jury and will not be shot down on cross-examination. Make sure that your expert is prepared amply for cross-examination and can withstand the attack
- ☐ Use DNA as one part of your arsenal of evidence. If all you have is DNA and the defense is ready with a good

cross-examination and a decent alibi, your case may come undone. Caution suggests that, if possible, you should not put all your eggs in the DNA basket.

- ☐ Know where the problems are in your case with respect to the DNA evidence. Consider carefully whether to explain such problems during the direct examination or whether you would be better off letting your expert explain such matters on cross-examination.
- ☐ When you conduct a direct examination, keep it simple and to the point. Do not try to provide too much detail to the jurors. For a test, try out the direct exam on the secretaries in your office and ask them for suggestions and comments after you have finished.

§ 11:89 Defense checklist

- ☐ Plan your strategy ahead of time. Do you want to concede that the DNA is that of your client (for example, in a consensual-question rape case)? Do you want to challenge the evidence head on? Plan well.
- ☐ Make sure you have a good handle on the law of admissibility in your jurisdiction before you try a case with DNA evidence. If your jurisdiction is one of those that either limits DNA or has questioned DNA, be prepared to argue against admissibility.
- ☐ If you will be handling a DNA case for the first time, make sure to discuss the science and the law thoroughly with an expert. Better yet, retain an expert to assist you in the preparation of your case.
- ☐ Know the science well before you attempt to cross-examine an expert. In the event you are confused about certain issues, make sure that you are clear on them before trial.
- ☐ If you are not making any headway on cross-examination, move to the safer subjects or simply stop the examination. When in doubt, stick to subjects such as bias and self-promotion for challenges.
- ☐ Do not try to outsmart a DNA expert unless (1) you are sure that the expert is only a technician who does not understand DNA, and (2) you have assistance in your cross-examination from an expert.

- ☐ Lay the foundation for your own expert's opinion (if appropriate) with the opposition's expert. It is a way of reinforcing what your expert will say and lending immediate credence to your expert's opinion.

CHAPTER III:

CROSS EXAMINATION

OF THE

DIFFICULT WITNESS

By

Pamela Robillard Mackey

Cross Examination of the Difficult Witness

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I. The Law of Cross Examination:

Crawford v. Washington, 541 U.S. 36, 124 S. Ct. 1354 (2004):

[The Confrontation Clause] commands, not that evidence be reliable, but that reliability be assessed in a particular manner: by testing in the crucible of cross-examination. ... Dispensing with confrontation because testimony is obviously reliable is akin to dispensing with jury trial because a defendant is obviously guilty. This is not what the Sixth Amendment prescribes.

541 U.S. at 61-62, 124 S. Ct. at 1370-1371.

Out of court statements by witnesses that are testimonial are barred under the Confrontation Clause unless witnesses are unavailable and defendants had a prior opportunity to cross-examine the witnesses, regardless of whether such statements are deemed reliable by a court alone.

Olden v. Kentucky, 488 U.S. 227 (1988):

Trial court's refusal to permit black defendant in kidnapping, rape and sodomy trial to cross-examine white complainant regarding her cohabitation with black boyfriend violated defendant's Sixth Amendment right to confrontation of witnesses; evidence was relevant to defendant's claim that he and complainant engaged in consensual sexual acts and that complainant, out of fear of jeopardizing her relationship with her boyfriend, lied when she told her boyfriend she had been raped.

Delaware v. VanArsdall, 475 U.S. 673 (1986):

A criminal defendant states a violation of the Confrontation Clause by showing that he was prohibited from engaging in otherwise appropriate cross-examination designed to show a prototypical form of bias on the part of a witness, and thereby to expose the jury to facts from which jurors could appropriately draw inferences relating to the witness' reliability; a ruling prohibiting the defendant from cross-examining into the possibility that a witness was biased as a result of the state's dismissal of his pending charge violated defendant's rights secured by the Confrontation Clause.

Davis v. Alaska, 415 U.S. 308 (1974):

Partiality of a witness is subject to exploration at trial and is always relevant as discrediting the witness and affecting the weight of his testimony: A defendant is denied his constitutional right of confrontation when he is precluded by protective orders from cross-examining key prosecution witnesses to show that they were on probation following an adjudication of juvenile delinquency, notwithstanding the statutory policy of protecting the anonymity of juvenile offenders, because the defendant has the right to attempt to show that the prosecution witness is biased because of his vulnerable status.

Winfield v. Commonwealth, 225 VA. 211, 301 S.E. 2d 15 (1983):

To be admissible under the “motive to fabricate” provisions of the rape shield law, evidence of past sexual conduct must show a pattern of behavior which directly relates to the conduct charged against the complaining witness in the case on trial; in a sex assault prosecution, there is a sufficient nexus between the complainant’s alleged efforts to extort money by threats from others after acts of prostitution, and the defendant’s version of her conduct in the instant case to render such evidence relevant and probative of a motive to fabricate.

Clinebell v. Commonwealth, 235, VA. 319, 368 S.E. 2d 263 (1988):

A defendant charged with sexual assault may cross-examine the accuser about prior false accusations of sexual assault and sexual conduct with other parties, despite rape shield law: testimony was offered not to prove the accuser had engaged in prior sexual conduct, but to attack her credibility by proving she had falsely claimed to have engaged in such conduct.

Barker v. Commonwealth, 230 VA. 370, 337 S.E. 2d 729 (1985):

Defendant on trial for rape and related charges should not have been prevented from cross-examining accuser with regard to her million dollar civil suit pending against her landlord for maintaining an unsafe premises, her attempts to receive benefits under a victim-assistance program requiring her cooperation with all law enforcement agencies, and her worker’s compensation claim that was based on a theory that she met the defendant in the course of her employment: these matters were relevant to show bias, self-interest, and motive to fabricate.

II. Preparation for Cross Examination

A. Witness files

1. All statements
2. All investigative reports
3. All background information

B. The Mechanics of Prep

1. Write it out
2. Paste impeachment information in precisely

III. Organization and Tone

A. Organization

1. Start and end on a strong note
2. Organize into subject areas and headline the areas
3. Consider perception, memory and bias
4. Use transitions - verbal and nonverbal cues

B. Tone

1. The more difficult the witness – the more matter-of-fact the tone.
2. Save sarcasm and incredulity for when you know the judge or jury is with you
3. Consider the length of cross and know when to quit

IV. Impeachment

- A. Be precise
- B. Use it early, but not too often

V. Some Particularly Difficult Witness

- A. The Eyewitness
- B. The Snitch
- C. The Accuser In A Sexual Assault Case
- D. The Child
- E. The Expert

VI. Great Books on Cross Examination

Examining Witnesses, by Michael E. Tigar (American Bar Association 1993)

Cross Examination: Science and Techniques, by Larry Pozner and Roger Dodd (2004)

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**EXCERPTS FROM
PAMELA ROBILLARD MACKEY'S
OUTLINE FOR CROSS
EXAMINATION OF
DETECTIVE DOUG WINTERS**

P. 164 list of items sent to CBI	Now, in addition to the semen in the panties and the pubic hair combings, the nurses in Glenwood gathered some swabs from the inner thigh and the perineum of Accuser.
P. 165 CBI report	Those swabs have semen and sperm on them correct?
Have August 20 letter from Mackey to Hurlbert requesting testing at independent lab ready	Those swabs have not been tested.
P. 161 Winters 7/10 supp report	The semen in the two pairs of panties caught your attention when you learned about it did it not?
P. 161 Winters 7/10 supp report	Indeed, you questioned Accuser on July 9, 2003 about the two semen stains that had been identified, but not yet tested, by Ms. Woods of CBI.
P. 161 Winters 7/10 supp report	<p>Upon your questioning Accuser told you that</p> <p>“Both panties were clean BEFORE she wore them. She stated on the night of the assault, when she got home, she took off the panties she was wearing and put on another clean pair. However, she claimed she had consensual sex with [someone] on 6/18/03 in which a condom was not used. She stated she doesn’t remember if those panties she changed into after the assault are the same panties she wore when she had sex with [someone].”</p>
	[some fourteen (14) days before]
P. 161 Winters 7/10 supp report	The Accuser told you she was “certain the semen found on the panties must be that of Bryant’s. She stated when she had consensual sex with [the man on June 28th], he used a condom.”
	But in fact it wasn’t Bryant’s was it?

	Did you ask Accuser who she had sex with after she left Mr. Bryant's room but before she got to Glenwood Springs?
	Why haven't you asked that question? [God only knows what he will say]
	Or is it because you are afraid of the answer?

	EVIDENCE OF CONSENT
	Now Detective Winters, I would like to direct your attention to the story Accuser told you and discuss that.
P. 961	The Accuser was working the front desk when the call came in from Kobe Bryant's travel agent
p. 961	She learned that Kobe Bryant was coming to the Cordillera that night
P. 961	The Accuser learns of Kobe Bryant's anticipated arrival at about 4:00 in the afternoon.
P 966	Now she is supposed to get off work at 7 pm but she stays late because she was "excited to meet Kobe Bryant."
P. 962	According to the Accuser, he arrives about 9:45 or 10:00?
P. 652 bellhop's time records	So, for about five hours the accuser is at work with the bellhop, before Kobe Bryant arrives.
P. 962	When Kobe Bryant arrives at the Cordillera, the Accuser is waiting in the lobby with his room key - correct?
P. 962	She escorts him to his room
P. 1014-1015	And it was Accuser who assigned those rooms
p. 264 Sandberg's report	Now you know Detective Winters, that prior to the call from Kobe Bryant's travel agent, only four rooms at the Cordillera were occupied.
P. 269	The Cordillera is a 56 room hotel?
P. 1014	So Accuser had over 50 rooms to choose from in her room assignment correct
p.963, p.269	She assigned Kobe Bryant a corner suite, at the very end of the hall as far away from the front desk and lobby as possible - correct?
P. 1018	That was the only room assigned on that floor in that wing of the hotel
p.269 P. 1014-1015	She assigned Kobe Bryant's security guards to a room at the other end of the hotel - a room on the other side of the lobby and front desk from Kobe Bryant's room

p.269 room 20 - p 965	She assigned Kobe Bryant's trainer a room in the same wing of the hotel as Kobe Bryant - but on a completely different floor.
P. 963 room 18 - p. 965	She enters the room with Kobe Bryant and his security people and his trainer
P. 963 "Mr. Bryant asked me kinda in private."	According to Accuser, Kobe Bryant asks her in a low voice and manner designed to keep them conversation just between them, asks her if she will return and give him a tour
P. 963	She agrees
P. 963	She leaves, along with the other folks, but returns, by herself to Kobe Bryant's room to give him a tour of the Hotel.
P. 964	Now she doesn't just stroll back to his room does she
p. 963-964	She tells you she goes the "back way."
P. 965	Specifically, she walks out the front door of the hotel as if she is leaving
P. 965	And then re-enters the hotel through the employee entrance
P. 965	She then goes through the employee area - out into the hall
P. 965	Grabs an elevator
P. 965	And arrives at Mr. Bryant's room
P. 964-95	She tells you that she does all this to avoid Kobe Bryant's security guards
P. 965	She doesn't want them to know she is going back to his room
P. 965	She arrives at this room and knocks on the door

P. 965	He answers
P. 965	And they begin the tour
p. 977 p. 986-87	During the tour, according to the accuser, she and Kobe Bryant are flirting and talking
p. 986	She tells you that he asks if she has a boyfriend.
P. 986	She says he flattered her about how she looked
p. 986	about how she was dressed
p. 977	She told you that during the tour Kobe Bryant "was being flirtatious with me and I was flirtatious back."
P. 977	And she told you that she "was excited that he was Kobe Bryant and showing interest in me."
P. 966	During the tour they just happen to meet the bellhop - not by the bell desk - but out on the terrace.
P. 967 Winters interview: Mr. Bryant asked you to escort him back to his room." P. 1017 Bennett interview "Cordillera is a very confusing hotel."	After to tour - Kobe Bryant asks the Accuser to help him find his room - not unusual request of a new guest at the Cordillera - it's a rather confusing floor plan - would you agree?
P. 967	The Accuser agrees and escorts Kobe Bryant to his room
P. 966	According to Accuser - once there Mr. Bryant invites her in.

P.966	She accepts.
	She goes into this secluded hotel room late at night of her own free will.
	Mr. Bryant doesn't drag her into the room - she just walks right in
p. 977 p. 986-87	And she walks in after she and Mr. Bryant have been flirting and talking during the tour
p. 977 p. 986-87	After she has, as she says, been flattered by Mr. Bryant's attention
p. 982 "he was showing interest in me and being flirtatious, asking me how old I was, asking if I had a boyfriend so a little part of me thought that he was gonna try and make a move on me."	And she told you - did she not - that she was expecting Kobe Bryant to put a move on her
	And with this knowledge, she willingly follows him into the hotel room
	Once in the room, the Accuser admits to you that she and Kobe Bryant sit down and begin to talk
p. 966	to "chit - chat" to use her words
p. 968 Jacuzzi p. 986	And the subject of this conversation is a Jacuzzi and tattoos
p. 986	Let's start with the discussion about the tattoos because of course that is what they talk about first

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**CROSS EXAMINATION OF
DETECTIVE DOUG WINTERS
AT OCTOBER 9, 2003
PRELIMINARY HEARING**

1 Q. You don't see an open wound of any kind, right?

2 A. It doesn't -- yeah, it doesn't appear to be open.

3 Q. And you don't really have any independent
4 knowledge of what those pictures show, correct?

5 A. I don't understand the question.

6 Q. Well, you can only tell the Judge what the nurse
7 told you about what those pictures show, right?

8 A. Well, based on what the nurse said, going over the
9 photo log, and it describing what it is, I have a good idea
10 what it is and where it's at, located at.

11 Q. But a key component of that is what the nurse told
12 you, correct?

13 A. That's part of it, yes.

14 Q. Well, I think we've established you don't have a
15 very good grounding in female genitalia; is that correct?

16 A. That's correct. I never really studied female
17 genitalia as far as --

18 THE COURT: It's not intended to be funny, so
19 let's --

20 Q. (By Mrs. Mackey) So the nurse had to show you --
21 the nurse had to explain to you where the posterior
22 fourchette was, correct?

23 A. That's correct.

24 Q. And she had to indicate that those pictures were
25 of the posterior fourchette?

1 A. That's correct.

2 Q. And she also opined that those pictures were, and
3 I want to get to the exact language here, were consistent --
4 I'm sorry. Let me find it here.

5 I think what you testified to on direct was that
6 what you see there is consistent with "penetrating genital
7 trauma," correct?

8 A. That's correct.

9 Q. Now, you don't have any expertise to make that
10 conclusion, correct?

11 A. That's correct.

12 Q. You have to rely on what the nurse told you?

13 A. That's correct. They're trained in that, so.

14 Q. And she told you that it was consistent with
15 penetrating genital trauma, correct?

16 A. That's correct.

17 Q. And she told you that it was not consistent with
18 consensual sex, right?

19 A. She stated that it -- these type of injuries you
20 wouldn't see in consensual type encounters. That's correct.

21 Q. And she said that the injuries were recent, but
22 she couldn't tell you how recent?

23 A. That's correct.

24 Q. Now, when you rely on that opinion that it was
25 consistent with penetrating genital trauma, did you ask her

1 if it was also consistent with a person who had had sex with
2 three different men in three days?

3 MS. BAKKE: Judge, objection.

PEOPLE V. BRYANT

**CROSS EXAMINATION OF
DETECTIVE DOUG
WINTERS CONTINUED AT
OCTOBER 15, 2003
PRELIMINARY HEARING**

1 CROSS-EXAMINATION (continued)

2 BY MRS. MACKEY:

3 Q. Detective Winters, on July 1st, 2003, when you
4 interviewed the accuser, you asked her when she last had
5 consensual sex, correct?

6 A. Yes.

7 Q. And she answered that question?

8 A. Yes.

9 Q. And she told you, "About three days ago," correct?

10 A. Yes.

11 Q. And she has recently corrected that to be very
12 specific as to June 28th, correct?

13 A. I'm not certain on the date, but I recall it's
14 either the 27th or 28th, somewhere in that area.

15 Q. And she told you that during that sexual encounter
16 that a condom was used, correct?

17 A. That's correct.

18 Q. And we know that the accuser admits to sexual
19 intercourse with Mr. Kobe Bryant on June 30th, correct?

20 A. That's correct.

21 Q. Let's now turn our attention to some of the
22 evidence which you collected in connection with your
23 investigation, sir.

24 A. Okay.

25 Q. When you first met with the accuser at her home in

1 the early afternoon of July 1st, 2003, you took from her the
2 clothing that she claimed she had worn the night before when
3 she had sexual intercourse with Mr. Bryant, correct?

4 A. That's correct.

5 Q. And included in that was a pair of panties,
6 correct?

7 A. Yes.

8 Q. Later on July 1st, 2003, the accuser goes to a
9 hospital in Glenwood Springs for a sexual assault
10 examination, correct?

11 A. Yes.

12 Q. And at that time she is wearing some yellow knit
13 panties, correct?

14 A. From what I was told, that's correct.

15 Q. And that appears in your case file, correct, sir?

16 A. Yes.

17 Q. And, in fact, you have seen those panties,
18 correct?

19 A. At the -- I believe the nurses packaged those
20 panties separately, so I don't have a direct recollection of
21 seeing those particular panties.

22 Q. But they're over there in your evidence locker,
23 right?

24 A. Yes.

25 Q. And those panties were taken from her by the

1 nurses on July 1st, 2003, correct?

2 A. Yes.

3 Q. Now, you testified last week that those panties
4 had a spot of blood in them, correct?

5 A. Yes.

6 Q. Now, in addition to that blood, there was also
7 semen and sperm found in those yellow panties, correct?

8 A. I remember semen, yes.

9 Q. In fact, you were called by an Agent Woods at the
10 C.B.I. and were told that there was a semen stain in the
11 yellow panties, correct?

12 A. Yes.

13 Q. And you submitted both of those panties, the ones
14 that you had collected earlier in the afternoon, as well as
15 the yellow knit panties, to the C.B.I. for forensic
16 evaluation, correct?

17 A. Yes.

18 Q. And the semen and sperm found in the yellow
19 panties collected at the hospital from the accuser, the
20 semen and sperm found in those panties did not match the DNA
21 profile of Mr. Bryant, correct?

22 A. In the yellow panties, that's correct.

23 Q. Stated another way, the accuser arrived at the
24 hospital wearing panties with someone else's semen and sperm
25 in them, not that of Mr. Bryant's, correct?

1 A. That's correct.

2 Q. During the sexual assault examination, there is
3 also a process in which the nurse examiners take pubic hair
4 combings from the accuser, correct?

5 A. That's correct.

6 Q. And the purpose of that is to determine if the
7 alleged rapist has left behind any of his pubic hairs during
8 the alleged assault, correct?

9 A. That's correct.

10 Q. And in this case, pubic hair combings were, in
11 fact, taken, correct?

12 A. That's correct.

13 Q. And found in those pubic hair combings were hairs
14 of Caucasian origin, correct?

15 A. That's correct.

16 Q. Again, not belonging to my client, Kobe Bryant,
17 correct?

18 A. That's correct.

19 Q. With regard to the semen and sperm in the yellow
20 panties, you don't know to whom that belongs, correct?

21 A. That's correct.

22 Q. You performed no tests to determine to whom that
23 belongs?

24 A. That's correct.

25 Q. And with regard to the Caucasian hair found in the

1 public hair of the accuser, you don't know to whom that
2 belongs?

3 A. That's correct. It could belong to her, it could
4 belong to somebody else. I don't know.

5 Q. You've done no testing, as we sit here three
6 months from the date of the alleged offense, to determine
7 whose hair that is, correct?

8 A. That's correct.

9 Q. You know testing that been requested, correct?

10 A. I believe so. I don't know.

11 Q. By the defense?

12 A. I -- I have some knowledge, yes, that's correct.

13 Q. But that testing has not been done?

14 A. That's correct.

15 Q. Now, you have asked two people who you think might
16 be responsible for that semen to provide you samples,
17 correct?

18 A. Yes, I did.

19 Q. And they have both refused?

20 A. I never had a chance to really speak with them.

21 But they --

22 Q. Those samples have never been provided, correct?

23 A. That -- that's correct.

24 Q. And it's your understanding one refused?

25 A. Yes.

1 MR. CRITTENDEN: Judge, I'm going to object to
2 relevance.

3 THE COURT: Where are we going?

4 MRS. MACKEY: That no testing has been done.

5 THE COURT: That's established. Let's move on.

6 Q. (By Mrs. Mackey) In addition to the semen in the
7 panties and the Caucasian hairs, there were additional swabs
8 taken from the accuser's body, correct, that contained semen
9 and sperm?

10 A. Yes.

11 Q. Those swabs have not been tested, correct?

12 A. Not to my knowledge. That's correct.

13 Q. So again, three months from the alleged offense,
14 still no testing, correct?

15 A. That's correct.

16 Q. You learned about the presence of the semen, not
17 Mr. Bryant's, of the Caucasian hair and of the other swabs
18 containing the sperm and semen, approximately the end of
19 July, correct?

20 A. Correct.

21 MR. CRITTENDEN: Judge, I'm going to object to the
22 form of the question. The detective never indicated that
23 there was sperm. He indicated that there was semen stains,
24 but -- she's indicating or she's making a conclusion that
25 hasn't been --

1 THE COURT: I think you can rephrase it with
2 regard to how he previously answered.

3 MRS. MACKEY: Sure.

4 Q. (By Mrs. Mackey) You learned about the semen in
5 the yellow panties that is not Mr. Bryant's, correct?

6 A. Yes.

7 Q. You learned about the Caucasian hair in the pubic
8 combings that is not Mr. Bryant's?

9 A. Yes.

10 Q. And you know that there are other swabs containing
11 sperm and semen that have not yet been tested, correct?

12 A. Yes.

13 Q. You testified last week about the opinion of the
14 nurse examiner with regard to the injuries, and I use your
15 phrase with that, the injuries that she observed on the
16 accuser, correct?

17 A. Yes.

18 Q. Before last Thursday, Detective, did you go back
19 and ask her whether this information that you had gathered
20 and knew as of July 28th affected her opinion in any way?

21 A. No. I never asked her that question.

22 Q. And you still have not done that as of today,
23 right?

24 A. I don't believe so, that's correct.

25 Q. Detective, I would now like to move on to

1 testimony from last week about blood on a shirt that you
2 retrieved from Mr. Bryant at the hotel. Do you recall that
3 testimony?

4 A. Yes.

5 Q. Now, the shirt that you retrieved, that the blood
6 was subsequently found on, that was actually the shirt that
7 Mr. Kobe Bryant was wearing when you first approached him in
8 the driveway of the hotel, correct?

9 A. Yes.

10 Q. You walked up to him, you and your partner, and
11 you began to question him, correct?

12 A. Yes.

13 Q. And you questioned him from sometime out in the
14 driveway, and then back again in his hotel room, correct?

15 A. Yes.

16 Q. And throughout that time frame he was wearing a
17 shirt where blood was later found, correct?

18 A. Yes.

19 Q. You did not observe any blood on his shirt as he
20 was speaking with you, correct?

21 A. Yes. Because the blood was on the inside of his
22 shirt.

23 Q. So just to make sure that we have that answer
24 correct, Detective, you did not observe any blood on
25 Mr. Bryant's shirt as you were questioning him over a

1 considerable amount of time, correct?

2 A. That's correct.

3 Q. In fact, the blood was not discovered until that
4 shirt was taken to C.B.I. for forensic analysis, correct?

5 A. Yes.

6 Q. And that's because the blood stain itself is so
7 faint that you can't see it from the outside, correct?

8 A. I'm not sure I understand your question, as far as
9 when you look at it on the inside. You can definitely see
10 it. From the outside, it's not very -- but if I recall
11 correctly, the shirt was tucked in at the time, too, when we
12 spoke with him.

13 Q. But you took the shirt from him?

14 A. Uh-huh.

15 Q. Correct?

16 A. That's correct.

17 Q. And you had it in your possession?

18 A. Yes.

19 Q. And you didn't notice the blood on it?

20 A. No.

21 Q. It took a forensic evaluation at C.B.I. to notice
22 that blood, correct?

23 A. That's correct.

24 Q. We just talked about the time that you were in
25 Mr. Kobe Bryant's hotel room, and this would have been in

1 the early morning hours of July 2d, 2003, correct?

2 A. Yes.

3 Q. By that time, you had already interviewed the
4 accuser, correct?

5 A. Yes.

6 Q. So you knew the story that she had told you,
7 correct?

8 A. Yes.

9 Q. And you knew that she claimed she had been forced
10 to wash her face before she was allowed to leave Kobe
11 Bryant's hotel room, correct?

12 A. Yes.

13 Q. What efforts did you make, Detective, to examine
14 the bathroom -- the bathroom area for evidence that that
15 event had occurred?

16 A. Detective Loya had indicated to me that he was in
17 the bathroom, and he -- he did scan the bathroom when he
18 went in there. So didn't -- didn't see anything of any
19 relevance at the time.

20 Q. And did you report that in your report?

21 A. I don't recall specifically.

22 Q. And so he just looked around to see if there was
23 anything of note?

24 A. That's what he said, yes.

25 Q. You didn't call anyone in to do fingerprints in

1 the bathroom?

2 A. No.

3 Q. You didn't call anyone in to see if there were
4 traces of the accuser's mascara or makeup in the bathroom?

5 A. No.

6 Q. You didn't examine any of the towels that were in
7 the bathroom?

8 A. No.

9 Q. You also knew that the accuser claimed that she
10 had bled, in her words, "a little," correct?

11 A. Yes.

12 Q. What efforts did you make to establish whether or
13 not there was blood in Mr. Kobe Bryant's hotel room?

14 A. Um, when we interviewed him, and the victim, their
15 statements were consistent with what they indicated had
16 happened, so I didn't see the need to have to examine for
17 something like that.

18 Q. So the answer is you did nothing to see if there
19 was any blood in the hotel room, correct?

20 A. That's correct. Just casual observations.

21 Q. And the accuser had specifically described to you
22 where she claimed that this alleged assault happened,
23 correct?

24 A. Both parties did, that's correct.

25 Q. And you didn't make any attempt to take a sample

1 of the carpet from that area, correct?

2 A. That's correct.

3 Q. To see if there was any blood whatsoever?

4 A. That's correct.

5 Q. And in fairness, Detective, was that in part
6 because the amount of blood was so *de minimis*, so small,
7 that you didn't expect to find any?

8 A. Well, there were a number of things. One was the
9 amount of blood, that it was a small amount; and two, the
10 statements that were given by both parties of where the
11 incident took place.

12 Q. Let me back up here for a moment, Detective. When
13 you were -- and I want to go back to you talking to the
14 nurse examiner and her opinion. Did you ask her whether
15 repeated acts of sexual intercourse could cause someone to
16 bleed?

17 A. I don't recall that specific question, as far
18 as -- I mean, could you be more specific as far as repeated
19 acts? I mean, are we talking about in a day, over a period
20 of time? I don't know.

21 Q. Sure. Based on what you now know about the facts
22 of this case, did you go back to her and ask if what you
23 know now, if that -- that series of events could have
24 resulted in a small amount of blood that you now describe?

25 A. I did ask her about any prior acts that could

1 cause those types injuries, would those injuries still be
2 apparent at that time. And her response was, it would be
3 unlikely if it occurred over, you know, two or three days.

4 Q. Over -- over the two or three days. But she did
5 say that the injuries were recent, correct?

6 A. Yes.

7 Q. But she couldn't tell you how recent?

8 A. Um, with talking with her further, she had stated
9 to me, within 24 hours.

10 Q. That's not in your report, is it, sir?

11 A. No, it's not.

12 Q. Let's -- let's look specifically at your report,
13 because your report says what I just said, correct?

14 A. I --

15 Q. That she told you that the injuries were recent,
16 that she simply couldn't tell how recent they were?

17 A. Right. And I spoke -- I've spoken with her
18 further about that, too, so.

19 Q. Since last Thursday?

20 A. Yes.

21 Q. So when this issue came up last Thursday, you went
22 back and talked to her some more?

23 A. Yes.

24 Q. But you still didn't ask her about her opinion in
25 light of all of the facts that we've established here this

1 morning, correct?

2 A. We've talked about some of them, but not all of
3 them, that's correct.

4 Q. Detective Winters, I'd now like to go through the
5 story that the accuser told you --

6 A. Okay.

7 Q. -- and examine that in a little more detail.

8 The accuser told you that she was working the
9 front desk when the call came in from Kobe Bryant's travel
10 agent, correct?

11 A. Yes.

12 Q. And she learned that it was Kobe Bryant who was
13 coming to the hotel that evening?

14 A. After a little bit of investigation, I would
15 guess.

16 Q. A little questioning of the travel agent?

17 A. Yes. Because the names were different at first.

18 Q. He -- the travel agent attempted to register him
19 under a pseudonym, correct?

20 A. Yes.

21 Q. But it became obvious in that initial conversation
22 that it was a pseudonym, and the person that was coming was,
23 in fact, Kobe Bryant?

24 A. Yes.

25 Q. And she learns about this at approximately 4:00 in

1 the afternoon?

2 A. I want to say between 4:00 and 4:30.

3 Q. Now, she's supposed to get off work at 7 o'clock
4 that evening, correct?

5 A. Yes.

6 Q. But she stays late. She stays until Mr. Kobe
7 Bryant arrives, correct?

8 A. Yes. Because she had arrived late, also.

9 Q. Yes. She actually gives you two reasons as to why
10 she stays late, correct?

11 A. Yes.

12 Q. And the first reason she gives you, and I'm now
13 quoting here, is, quote, she was excited to meet Kobe
14 Bryant, closed quote?

15 A. That's correct.

16 Q. She also said that she was late because of car
17 trouble and so wanted to make up the hours?

18 A. Yes.

19 Q. Now, according to the accuser, Kobe Bryant arrives
20 about 9:45 or 10 o'clock?

21 A. Yeah. Somewhere between 9:45 and 10:00. That
22 sounds about right.

23 Q. So for about five hours, the accuser is at work
24 with the bellhop before Mr. Bryant arrives, correct?

25 A. I don't know what time the bellhop -- the

1 bellhop was there, so I never --

2 Q. You never inquired what time he got to work?

3 A. Another detective did that interview, and I don't
4 recall seeing exactly what time that was, so.

5 Q. I'll just bring you one at a time, Detective,
6 because they're so big.

7 A. Okay.

8 MRS. MACKEY: May I approach?

9 THE COURT: You may.

10 Q. (By Mrs. Mackey) These are the same notebooks
11 that I gave you last week, Detective, and they contain the
12 discovery or police reports that have been provided to us by
13 the prosecution. And I'm looking there at page number 652.
14 That is the time card for the bellhop. And you see there
15 that he gets in to work at about 2:28 in the afternoon?

16 A. That shows when he -- it looks like he checked in,
17 yes.

18 Q. Okay. So seeing that now, does that allow you to
19 agree with me that for about five hours the accuser and the
20 bellhop worked together?

21 A. I still don't know that they worked together.
22 They were there at the same time.

23 Q. Okay. Fair enough.

24 When Kobe Bryant arrives at the hotel, the accuser
25 is waiting in the lobby with his room key, correct?

1 A. Yes, I believe so.

2 Q. And she escorts him to the hotel room?

3 A. Yes.

4 Q. She is accompanied by Mr. Bryant, his two security

5 guards, and his trainer, correct?

6 A. Yes. But in the interview I think she just states

7 that there were two other people, so.

8 Q. You are correct. She forget one?

9 A. Uh-huh.

10 Q. But you now know that there were actually three

11 others?

12 A. Yes, I do.

13 Q. Okay. And the accuser had assigned Mr. Kobe

14 Bryant the hotel room to which she takes him, correct?

15 A. I don't know how it was all assigned, but she

16 takes him to a room that was reserved for him.

17 Q. Well, she's working the front desk, correct?

18 A. Yes. So.

19 Q. And there was no one else to assign those rooms,

20 correct?

21 A. I --

22 MR. CRITTENDEN: Objection. Speculation.

23 MRS. MACKEY: I'm asking if he knows that there's

24 anyone else that could have assigned the rooms.

25 THE COURT: You may ask that question.

1 THE WITNESS: I don't know if anybody else could
2 have assigned the rooms. It's my understanding that she may
3 have, so I don't specifically remember if I asked her that.

4 Q. (By Mrs. Mackey) But it's your understanding that
5 she may have assigned that room?

6 A. That's correct.

7 Q. Okay. And you know that the hotel is about a
8 56-room hotel?

9 A. I don't know how many rooms there are, but that
10 sounds about right.

11 Q. I have to give you the other notebook.

12 A. Okay.

13 MRS. MACKEY: And, Judge, if I could also ask for
14 an exhibit to be marked.

15 THE COURT: Have you marked it, or are you asking
16 to mark it?

17 MRS. MACKEY: I have a sticker on it, but I don't
18 have a number. And I didn't know if you wanted us to do
19 letters or numbers.

20 THE COURT: Let's do -- what is the State?
21 State's 1. So let's do letters.

22 MRS. MACKEY: Okay. Exhibit A, then.

23 Q. And it's page 269, Detective.

24 Do you want me to move this for you?

25 A. No. That's fine. 269, you said?

1 Q. Yes. That was provided by the hotel pursuant to a
2 subpoena duces tecum. You've seen that before, correct,
3 Detective?

4 A. No, I have not.

5 Q. That is a lodge room map of the hotel where
6 Mr. Bryant was staying. And you see in the upper left-hand
7 corner there, it says rooms 50 to 56, and that's as high as
8 it goes. Do you see that?

9 A. Yes.

10 Q. Now, you're also aware that prior to Mr. Kobe
11 Bryant coming in to that hotel, that there were only four
12 rooms occupied, correct?

13 A. I learned that after.

14 Q. You know that as you sit here today?

15 A. Yes. I know that now.

16 Q. Okay. So there were 52 rooms from which the
17 accuser could choose the rooms that she assigned to Mr. Kobe
18 Bryant and his party, correct?

19 A. Yes.

20 Q. Now, she assigned room 35 to Mr. Kobe Bryant,
21 correct?

22 MR. CRITTENDEN: Objection. Again calls for
23 speculation.

24 THE COURT: Well, I think that there had been
25 previous testimony by this witness that he thinks that she

1 did do it. Now, to the extent that we give credibility to
2 that piece of information, it goes to what I think he means.
3 So I'd overrule it at this time.

4 MR. CRITTENDEN: Then, Judge, I would also object
5 to relevance.

6 THE COURT: That could be a more interesting
7 issue.

8 Where are we going?

9 MRS. MACKEY: Judge, I think that -- do you want
10 to do this here or at the bench?

11 THE COURT: We could do it right there.

12 MR. CRITTENDEN: Judge, we could go up to the
13 bench. That's fine.

14 THE COURT: Okay. If you want to come on up.

15 All right. Loud enough so that Ms. Goodbee can do
16 the record, please.

17 (The following conference then occurred at
18 sidebar.)

19 MRS. MACKEY: What this evidence is going to
20 establish is that she assigned rooms putting Mr. Kobe Bryant
21 at one end of the hotel, and the rest of his party at the
22 other, and that she knew that.

23 THE COURT: Well, the relevance of that goes to?

24 MRS. MACKEY: It goes to the consent, Judge. I'll
25 move through it quickly.

1 THE COURT: To the extent you can get that in,
2 I'll let you try. I'm not sure you can, because to the
3 extent the witness doesn't know, then the speculation comes
4 in.

5 MRS. MACKEY: Okay. Thanks, Judge.

6 (The following proceedings were held within the
7 hearing of the public.)

8 Q. (By Mrs. Mackey) Detective, you know that
9 Mr. Kobe Bryant stayed in room 35 on June 30th and July 1st,
10 correct?

11 A. Yes.

12 Q. And you know that that's a first floor room at the
13 very end of the first floor hall, correct?

14 A. That sounds right.

15 Q. And that you know that the accuser told you that
16 that was as far away from the front desk and lobby area as
17 you could get, correct?

18 A. That -- the only -- I think that comes up when
19 she's describing how to get there, because it's kind of a
20 confusing setup on how to get there. So I think that's what
21 she says, in context.

22 Q. Would you like to see it in --

23 A. Yes. Just to be more --

24 Q. Sure. Page 963. And you ask her, Where is that
25 located in the lodge? Because I'm not very familiar with

1 the rooms. She responds, it's actually the very last room
2 on the first floor, about the farthest room you could get
3 from the front desk or the lobby area.

4 A. Yes.

5 Q. The security guards were in room 18, correct?

6 A. I don't know specifically what rooms they were in.
7 I just know two rooms that were for them. I don't know
8 which rooms who was in.

9 Q. Okay. Let's see where that is. You didn't go to
10 the room where the security guards were that evening?

11 A. No, I did not.

12 Q. But you're aware that in a recent interview the
13 accuser had stated that they did stay in room 18?

14 A. I don't know.

15 Q. If you'll look at page 1014.

16 MR. CRITTENDEN: Judge, I'm going to object. The
17 information that she's referring to, this officer knows
18 nothing about, and it would be, as the Court's prior ruling,
19 double hearsay, which the Court is not allowing.

20 THE COURT: Let's move on.

21 MRS. MACKEY: Judge, this comes from a
22 tape-recorded interview of the accuser that there's a
23 transcript of. This is in the officer's case file.

24 THE COURT: Not in my file. So if he is
25 indicating to you that he has no knowledge of it, that's

1 where we are.

2 I have this chair here to that put one of those
3 books not being used.

4 THE WITNESS: Okay. Thank you.

5 Q. (By Mrs. Mackey) Did you investigate where the
6 trainer that accompanied Mr. Kobe Bryant stayed?

7 A. No.

8 Q. So you did not do any investigation to determine
9 whether the rest of Mr. Kobe Bryant's party was staying on
10 the night of June 30th?

11 A. I just knew two rooms that they were staying in,
12 and I left it at that.

13 Q. You didn't know where they were?

14 A. Physically?

15 Q. Yes.

16 A. I had an idea where they were when we were talking
17 with them that night.

18 Q. And what was your idea?

19 A. They were with other detectives, I believe, in the
20 lobby.

21 Q. No, no, no. I'm sorry. I'm not being clear. Did
22 you know where the rooms to which they had been assigned
23 were?

24 A. No.

25 Q. You didn't do any investigation that night to see

1 how close the security guards were to Mr. Kobe Bryant?

2 A. That's correct.

3 Q. Didn't ask any of those questions?

4 A. I don't recall right offhand, no.

5 Q. Nor as to the trainer, correct?

6 A. That's correct.

7 Q. And you've done nothing since July 1st or 2nd to
8 determine where those people were staying, correct?

9 MR. CRITTENDEN: Judge, again I'm going to object
10 to relevance. This has been asked and answered.

11 THE COURT: One last question, then let's move on.

12 Q. (By Mrs. Mackey) And you've done nothing since
13 July 1st or 2nd to determine where those people were
14 staying, correct?

15 A. Thank you.

16 MRS. MACKEY: My able cocounsel has just fixed
17 this problem, Your Honor.

18 THE COURT: Remains to be seen.

19 Q. (By Mrs. Mackey) Could you look at page 965, sir,
20 which is your interview of the accuser. Third line down.

21 A. Uh-huh.

22 Q. Your question, What rooms were the bodyguards in?
23 Answer, 18 and 20?

24 A. Uh-huh, yes.

25 Q. So you, in fact, did know?

1 A. I just know they were two rooms. I don't know if
2 they were in 18 or 20. I guess you could assume both.
3 There were three people --

4 Q. Well, it says "18 and 20," correct?

5 A. Uh-huh. Yes.

6 Q. And she told you that she had assigned three
7 rooms, correct?

8 A. Yes.

9 Q. So she assigned Mr. Kobe Bryant 35, correct?

10 A. Yes.

11 Q. And she assigned the other two 18 and 20?

12 A. Yes. For the remaining parties.

13 Q. Okay. Now, let's go back to Exhibit A, page 269
14 of the discovery. Looking at that map, sir, room 18 is on
15 the other end of the hotel from room 35, correct?

16 A. Yes.

17 Q. It's beyond the spa and lobby area and the front
18 desk, correct?

19 MR. CRITTENDEN: Judge, again, I'm going to object
20 to the line of questioning as to relevance. This is a
21 preliminary hearing. We're supposed to be going to the
22 probable cause as to the elements.

23 THE COURT: I agree. It's not -- if anyone
24 thought I was dense enough not to figure this out, I now
25 officially declare that I'm not that dense. I got it.

1 Let's move on to the next topic. The rooms are far apart.

2 MRS. MACKEY: Okay. And she's done.

3 THE COURT: We think. All right. Let's go.

4 Q. (By Mrs. Mackey) The accuser takes Mr. Kobe
5 Bryant down to his room, and while she's there, she says
6 that Mr. Kobe Bryant pulls her aside and has a private
7 conversation with her, correct?

8 A. Yes.

9 Q. And that he asks her to return in about 15 minutes
10 to give him a tour of the hotel?

11 A. Yes.

12 Q. And she agrees?

13 A. Yes.

14 Q. She leaves at that point, along with the other
15 folks, but then she returns by herself back to Mr. Bryant's
16 room?

17 A. Yes.

18 Q. And she returns by what she calls the, quote, back
19 way, closed quote. Correct?

20 A. Yes.

21 Q. And she describes that as going out the front
22 entrance to the hotel, correct?

23 A. Yes.

24 Q. As if she was leaving?

25 A. Yes.

1 Q. She takes a left around to an employee entrance?

2 A. Yes.

3 Q. She comes through that employee entrance into the
4 employee cafeteria?

5 A. Yes.

6 Q. She comes out the employee service entrance into a
7 hall, correct?

8 A. Yes.

9 Q. She takes an elevator down to the first floor,
10 correct?

11 A. Yes.

12 Q. And then finally arrives at Mr. Bryant's room,
13 correct?

14 A. Yes.

15 Q. And she tells you this is because she doesn't want
16 to create a hassle, those were your words last week, with
17 the bodyguards, correct?

18 A. That's correct.

19 Q. Basically, she doesn't want them to know that
20 she's going back to the room?

21 A. Yes.

22 Q. Right? She gets to the room, she knocks, and
23 Mr. Bryant answers, correct?

24 A. Yes.

25 Q. And then they go on a tour, correct?

1 A. Yes.

2 Q. And they tour the public areas of the hotel,
3 correct?

4 A. Yes.

5 Q. And during that tour, according to the accuser,
6 she and Mr. Bryant are flirting and talking, correct?

7 A. Yes.

8 Q. She tells you that he asks if she has a boyfriend?

9 A. Yes.

10 Q. She tells you that she is flattered because he
11 asks her -- he tells her that she looks nice. Something to
12 that effect?

13 A. That's -- yes.

14 Q. And that she's flattered because he compliments
15 her on the way she's dressed?

16 A. Yes.

17 Q. And she told you that during the tour with
18 Mr. Bryant, that she was being flirtatious with -- that he
19 was being flirtatious with her, and she was being
20 flirtatious back, correct?

21 A. Yes.

22 Q. And she told you that she, quote, "Was excited
23 that he was Kobe Bryant and was showing interest in her,"
24 correct?

25 A. That's correct.

1 Q. Now, during this tour they just happened to meet
2 the bellhop, right?

3 A. At some point, yes.

4 Q. He's not out by the bell stand?

5 A. I don't know where he's at.

6 Q. Well, he's out by the terrace, right?

7 A. I'm not sure.

8 Q. Do you want to look at page 966?

9 A. Yes. That's correct.

10 Q. Okay. So meets him out by the terrace. They chat
11 for a while, they talk to some other guests. And then Kobe
12 Bryant asks for help getting back to his room, correct?

13 A. Yes, I believe so.

14 Q. And she agrees?

15 A. Yes.

16 Q. She takes him back to the room?

17 A. Yes.

18 Q. And he invites her in, according to her?

19 A. Yes.

20 Q. And she goes into the room, correct?

21 A. Yes.

22 Q. Of her own free will, correct?

23 A. Yes.

24 Q. Mr. Kobe Bryant doesn't drag or pull or push her
25 in, correct?

1 A. That sounds correct. I don't think he did.

2 Q. She just walks in?

3 A. Yes.

4 Q. And she told you that when she went into that
5 room, she was expecting Kobe Bryant to, quote, "put a move
6 on her," correct?

7 A. I don't recall that.

8 Q. Do you want to look at page 982? It's about
9 halfway down the page. If you need help finding it, I'll
10 come point it out to you.

11 A. Okay.

12 Q. Have I quoted that correctly?

13 A. Uh-huh, yes.

14 Q. And with this feeling or knowledge, she willingly
15 goes in to this hotel room at the end of the hall, correct?

16 A. Yes. She -- she does state, though, she thought
17 he was going to try to make a move on her.

18 Q. Right. Right.

19 A. So that's.

20 Q. Once in the room, the accuser tells you that,
21 according to her, she and Mr. Bryant sit down, and, in her
22 words, begin to chitchat, right?

23 A. Yes.

24 Q. And the subject of this conversation is Jacuzzis
25 and tattoos?

1 A. Yes, I believe so. Yes.

2 Q. And we'll start with the tattoos, because that was
3 the first part of the conversation as she related it to you,
4 correct?

5 A. Yes.

6 Q. Now, she has two tattoos, correct?

7 A. That I knew of, yes.

8 Q. At the time she only told you about one tattoo,
9 right?

10 A. Yes.

11 Q. The one on her ankle?

12 A. Yes.

13 Q. But you know now she also has one on her back?

14 A. Yes.

15 Q. Right? Now, she never mentioned that to you
16 during this particular initial interview with her, correct?

17 A. I don't believe so.

18 Q. But you know now that she has one on her, on her
19 lower back, correct?

20 A. I'm not --

21 MR. CRITTENDEN: Objection. Calls for
22 speculation.

23 MRS. MACKEY: I'm asking him if he knows.

24 THE COURT: I think that's the whole point of it.

25 MR. CRITTENDEN: Okay.

1 THE COURT: But I think she's asking that. If you
2 don't know, you don't know.

3 THE WITNESS: I know it's on her back, I don't
4 know the exact location.

5 Q. (By Mrs. Mackey) You don't know where it is?

6 A. I never saw it. That's correct.

7 Q. And you know that she has admitted to pulling the
8 strap of her dress down to show that tattoo to Mr. Bryant,
9 correct?

10 A. No.

11 Q. You've never heard that?

12 A. No. I don't recall her saying that specifically,
13 unless, you know, I could double-check the transcript. I
14 remember what Mr. Bryant said about pulling a strap or
15 something like that, so.

16 Q. Pulling a strap?

17 A. Yeah.

18 Q. But you're not aware of her recent statements
19 about that issue in a recent interview?

20 A. No.

21 Q. Okay. You collected the clothing from the accuser
22 on July 1st, 2003, correct?

23 A. Yes, we did.

24 Q. None of that clothing was damaged in any way,
25 correct?

- 1 A. I guess, specify "damage."
- 2 Q. No rips, no tears?
- 3 A. It didn't appear to be, no.
- 4 Q. Now, after they get done talking about these
- 5 tattoos, the conversation turns to the Jacuzzis, correct?
- 6 A. Yes.
- 7 Q. The Jacuzzi at the hotel is out in a public area,
- 8 correct?
- 9 A. I know there is one out in the public area. I
- 10 don't think there's another one somewhere else, so.
- 11 Q. And there was not one in Mr. Bryant's hotel room?
- 12 A. No.
- 13 Q. So she tells you that Mr. Bryant's interested in
- 14 having a Jacuzzi with her, correct?
- 15 A. Going to the Jacuzzi, yes.
- 16 Q. And the one that you're aware of is out in the
- 17 public place, correct?
- 18 A. Yes.
- 19 Q. And she tells you that she's getting a little
- 20 uncomfortable or a little worried about this conversation,
- 21 correct?
- 22 A. Yes.
- 23 Q. But she doesn't go out to the public place where
- 24 the Jacuzzi is, does she?
- 25 A. No. No. No.

1 Q. In fact, what she does is she stands up, and she
2 doesn't even tell Mr. Bryant that she's a little worried
3 about the situation, does she?

4 A. I don't know what she told him. I don't think she
5 told him anything like that, no.

6 Q. She didn't tell him she was uncomfortable with the
7 situation, did she?

8 A. I don't --

9 MR. CRITTENDEN: Judge, I'm going to object.
10 Speculation.

11 THE COURT: Well, it seems to me that -- well --

12 MR. CRITTENDEN: The form of her question was
13 asking for speculation on the part of the detective.

14 THE COURT: Well, I thought the form of the
15 question was to determine whether the accuser had indicated
16 in her interviews with this witness whether she had
17 communicated her lack of comfort.

18 MR. CRITTENDEN: Okay. That I didn't hear from
19 the --

20 THE COURT: Was that the intent?

21 MRS. MACKEY: Yes, sir.

22 THE COURT: All right. Ask it along those lines.

23 Q. (By Mrs. Mackey) She didn't tell Mr. Bryant that
24 she was getting uncomfortable with this situation, correct?

25 MR. CRITTENDEN: Again, I object to the form of

1 the question. It asks for speculation.

2 THE COURT: How about, what did she tell about
3 that?

4 Q. (By Mrs. Mackey) Did she tell Mr. Bryant that she
5 was uncomfortable?

6 MR. CRITTENDEN: Again, Judge, objection.

7 THE COURT: Well, that objection I'm going to
8 overrule. You may ask that question.

9 Q. (By Mrs. Mackey) Did she tell Mr. Bryant that she
10 was getting uncomfortable with the situation?

11 A. No.

12 Q. Now, when she stood up, at that point she stood
13 up, and, according to her, Mr. Bryant asks for a hug,
14 correct?

15 A. Yes.

16 Q. And she hugs him back?

17 A. Yes.

18 Q. And they begin kissing, correct?

19 A. Yes.

20 Q. And she tells you that this hugging and kissing
21 goes on for about five minutes, correct?

22 A. Yes.

23 Q. And she tells you that this hugging and kissing is
24 totally consensual, correct?

25 A. Yes.

1 Q. She tells you that she drapes her arms around his
2 neck?

3 A. Yes.

4 Q. While she's kissing him?

5 A. Yes.

6 Q. And you've learned that this kissing also involved
7 French kissing, correct?

8 A. I don't know.

9 Q. So again you're not aware of the recent interview?

10 A. No.

11 MR. CRITTENDEN: Judge, I'm going to object to
12 that as being asked and answered. He's already indicated
13 he's not aware of any recent interview.

14 THE COURT: Well, it is now. Go on.

15 Q. (By Mrs. Mackey) She is fully and willingly
16 participating in this hugging and kissing, correct?

17 A. She said she consented to it.

18 Q. Then she tells you that Mr. Bryant begins to touch
19 her in ways that she doesn't want, correct?

20 A. More specifically, she said "groping," yes.

21 Q. And that she resists?

22 A. Yes.

23 Q. Now, in addition to the sexual assault exam that
24 was performed on the accuser, Mr. Bryant also underwent a
25 sexual assault exam, correct?

1 A. Yes.

2 Q. And included in that was a full body exam of him
3 to see if there were any marks on his body, correct?

4 A. Yes.

5 Q. And when the nurse examiners looked him over from
6 head to toe, they didn't see a single scratch on him,
7 correct?

8 A. That's correct.

9 Q. Not a single red mark, correct?

10 MR. CRITTENDEN: Judge, I'm going to object. This
11 is beyond the scope of direct.

12 THE COURT: Mrs. Mackey.

13 MRS. MACKEY: Judge, this goes directly to lack of
14 force. There is not a mark on Mr. Bryant's body to indicate
15 that he was involved in any struggle whatsoever.

16 THE COURT: It's the flip side of this coin.
17 Overruled.

18 Q. (By Mrs. Mackey) Not a single red mark, correct?

19 A. That's -- other than his knee operation, they made
20 comment on that.

21 Q. The surgical incisions. Sure.

22 A. Uh-huh.

23 Q. But nothing to indicate he'd been involved in any
24 kind of a struggle whatsoever, correct?

25 A. There were no marks on him.

1 Q. Now, she also claims to you, Detective, that when
2 she tried to get out of the room, that Mr. Bryant blocked
3 her way to the door, correct?

4 A. Yes.

5 Q. Which door?

6 A. The exit door.

7 Q. Well, there's three doors out of that hotel room,
8 correct?

9 A. I think there's two sliding glass doors and a main
10 door.

11 Q. Right. And so the main door goes into the hall,
12 correct?

13 A. Yes.

14 Q. But the two sliding glass doors go out onto a
15 ground floor patio, correct?

16 A. Yes.

17 Q. So which door was he blocking her way to?

18 A. The door out to the hallway.

19 Q. Did you ask her that specifically?

20 A. Um, the way she described it, I understood what
21 she was talking about.

22 Q. Did you ask her why she didn't go out the sliding
23 door?

24 A. No.

25 Q. After you had interviewed the accuser, both at her

1 home and at the sheriff's office, you were concerned, based
2 on what you had heard, that she had never clearly told Kobe
3 Bryant "no," correct?

4 MR. CRITTENDEN: Judge, I'm going to object to
5 relevance. In regards to what the case law, Judge,
6 People v. Dunton talks about if force is applied and there's
7 evidence of that force, consent doesn't matter.

8 THE COURT: You asked the questions on direct.
9 Overruled.

10 A. At the time that -- when I was conducting the
11 interview with her, I was also taking notes. So when I
12 asked her a lot of those questions, I may have over -- it
13 was a miscommunication on my part. But after reviewing
14 reports, she did indicate that she had told me in the
15 interviews that she had told him "no" on a couple different
16 occasions.

17 Q. (By Mrs. Mackey) Well, but you, in your report --
18 and I'll direct you to page 21 of the discovery -- you
19 clearly say, "I asked the accuser why she never told Bryant
20 'no.'" You asked her that, didn't you, Detective?

21 A. Yes, I did.

22 Q. And her response was not, oh, but I did. That's
23 not how she responded to you, was it?

24 A. I'd asked her the question of why she never told
25 Bryant no. I followed up by asking her, what things did she

1 do that would make Bryant realize that she wasn't a
2 consenting party to the sexual acts. And she answered --

3 Q. But she never protested to you and said, but
4 Detective, I did tell him no?

5 A. I don't recall specifically if she said that.

6 Q. Well, you certainly would have put that in your
7 report, wouldn't you?

8 A. Maybe. Yes, I would think so.

9 Q. And it's not in your report?

10 A. No.

11 Q. You know now, based on your investigation, that
12 one of the few other rooms assigned at the hotel that night
13 was the room directly above Mr. Kobe Bryant, correct?

14 MR. CRITTENDEN: Judge, again. Objection. The
15 relevance.

16 THE COURT: Where are you going?

17 MRS. MACKEY: They heard nothing, Judge.

18 THE COURT: Overruled.

19 Q. (By Mrs. Mackey) Correct?

20 A. I believe there was a room that was rented above
21 his. Or that was occupied the night of the -- the incident.

22 Q. And that they slept with their windows open?

23 A. I don't recall about their windows were open or
24 not.

25 Q. Do you want to look at page 266. It's the last

1 paragraph. And please don't read their names.

2 MR. CRITTENDEN: Judge, I'm going to object.
3 She's asking for information based not on what this
4 detective knows, but based on hearsay evidence that another
5 person knows.

6 THE COURT: Which would be about the totality of
7 the evidence.

8 Here's the thing -- could you come up, please.

9 (The following conference then occurred at
10 sidebar.)

11 We -- my concern is I don't intend this to be a
12 trial on all of the potential issues.

13 It goes, to my mind, to trying to establish the
14 absence of probable cause.

15 MRS. MACKEY: Well, it goes to -- technically,
16 Judge, what it goes to is the lack of force.

17 THE COURT: Okay.

18 MR. CRITTENDEN: Judge, I don't know how that goes
19 to the lack of force.

20 MRS. MACKEY: My question would be, did anybody
21 overhear anything to suggest that there was something
22 forceable happening?

23 MR. CRITTENDEN: But they're also basing this on
24 information that he doesn't personally have knowledge of.
25 He's referring to information that has been gotten from

1 hearsay, which is double hearsay from another source.

2 THE COURT: Let's talk about that. The source of
3 the information is what?

4 MRS. MACKEY: It's an interview by Jerry Sandberg
5 of the DA's office that finds its way into his case filing.

6 THE COURT: So it falls into this double hearsay
7 issue.

8 MR. CRITTENDEN: Yeah.

9 MRS. MACKEY: But, Judge, what happened last week
10 was I objected on the double hearsay when the question was
11 about what the accuser claimed the bellhop had said. When
12 the question was based on what have other officers told you,
13 what else do you know from the totality of this
14 investigation, I very carefully did not object, because I
15 think that falls under the fellow officer rule.

16 THE COURT: Well, let me ask this. As I
17 understand it, and I may be wrong, that at that point the
18 investigation shifted from one agency to another agency,
19 from the sheriff's office to the DA's office?

20 MR. CRITTENDEN: The investigation, yeah, that's
21 right. Correct.

22 THE COURT: And what knowledge did this officer
23 have about what was conducted by the district attorney's
24 office?

25 MR. CRITTENDEN: None, as far as I know.

1 THE COURT: Mrs. Mackey.

2 MRS. MACKEY: But he's already testified to things
3 that came out of the DA's investigation saying that he's
4 known that.

5 THE COURT: Well, I'm certain that there's been a
6 lot of testimony that's come in that could have formed the
7 basis of an objection.

8 Here's my concern, is that --

9 MR. CRITTENDEN: Judge, just also regarding the
10 double hearsay, everything he testified to, he has personal
11 knowledge of. It wasn't something that he knew from another
12 officer --

13 THE COURT: Okay. I do have some concerns with
14 that assertion. For example, I don't think we need to get
15 into that. But I mean, on the grounds of double hearsay
16 objection, I'll sustain.

17 (The following proceedings were held within the
18 hearing of the public.)

19 MRS. MACKEY: May I have just a moment, Judge?

20 THE COURT: You may.

21 Q. (By Mrs. Mackey) Final part, series of questions
22 about what the accuser told you when you interviewed her in
23 early July.

24 What she tells you is that during what she claims
25 is a sexual assault, that when she started to get a little

1 more aggressive and tried harder to get away, that's when he
2 stopped, correct?

3 A. Yes.

4 Q. And he did stop, correct, Detective?

5 A. Yes.

6 Q. What the accuser tells you is that when she
7 effectively communicated with Mr. Bryant, he stopped, right?

8 A. What do you mean by "effectively communicated"
9 with him?

10 Q. When she took her hand and moved his hand away, he
11 stopped?

12 A. If you want to call that communicate, then yes.

13 Q. Okay. All right. Forget what -- the label I put
14 on it.

15 A. Okay.

16 Q. Okay. There's no dispute that he stopped,
17 correct?

18 A. Yes. Yes.

19 Q. Let's now talk about what happens after the
20 accuser leaves Mr. Kobe Bryant's room.

21 The first person that she meets is the night
22 auditor for the hotel, correct?

23 A. Yes.

24 Q. And the night auditor tells you that she does not
25 believe that the accuser was assaulted, correct?

1 MR. CRITTENDEN: Judge, I'm going to object. It's
2 asking for information from double hearsay.

3 MRS. MACKEY: It's right in his report, Your
4 Honor.

5 MR. CRITTENDEN: It's not in his report.

6 THE COURT: Page and line?

7 MRS. MACKEY: It's on page 20 of his report.

8 THE COURT: Why don't you establish what occurred
9 between this officer and the night auditor.

10 THE WITNESS: Can I add something? I didn't
11 interview the night auditor. That was another deputy.

12 Q. (By Mrs. Mackey) You wrote the report up,
13 correct?

14 A. I did write the report up, yes, from what she told
15 me.

16 Q. From what she told you?

17 A. Yes.

18 Q. Right. Okay.

19 MR. CRITTENDEN: So again, Judge, it's double
20 hearsay.

21 MRS. MACKEY: I thought he just said from what the
22 night auditor said.

23 THE WITNESS: From the deputy said.

24 THE COURT: If I understand correctly what
25 occurred, Deputy Winters wrote a report based upon what

1 another officer told him about an interview with a third
2 person.

3 Q. (By Mrs. Mackey) She did also provide you a typed
4 statement, correct?

5 A. I believe so, yes.

6 Q. And that's in your report, correct? In your case
7 file?

8 A. It's in the case file, yes.

9 Q. And you've seen that?

10 A. Yes.

11 *Mr. Crittenden:*
~~MRS. MACKEY:~~ And Judge, I'd also then also object
12 to the line of questioning of this as to relevance.

13 THE COURT: Make an offer. Where are we going?

14 MRS. MACKEY: Judge, this was the very first
15 person that --

16 MR. CRITTENDEN: Judge, I'd ask to approach.

17 (The following conference then occurred at
18 sidebar.)

19 MRS. MACKEY: This is the very first person that
20 sees the accuser upon her leaving Mr. Bryant's room. This
21 is the person that -- with -- who stood beside her during
22 the time that she did the paperwork that the prosecution
23 asked about last week. This is the person that observed the
24 accuser immediately upon her exit from Mr. Bryant's room.
25 It goes --

1 THE COURT: Okay.. What is different about this
2 and the prior line of questioning than what you asked on
3 direct with regard to the bellman's comment?

4 MR. CRITTENDEN: My bellman's comment was as to
5 her demeanor. As to what this person says and her
6 credibility and whether she believes her, this person met
7 her for the first time that night. And as for what this
8 person believes, whether or not to believe a stranger or to
9 believe or not --

10 THE COURT: What I will allow is questions in
11 regards to the demeanor only.

12 (The following proceedings were held within the
13 hearing of the public.)

14 Q. (By Mrs. Mackey) Do you need to refer to that
15 written statement, Detective, that's on page 47?

16 A. Yes. If I may.

17 Q. Sure. Do you have it there in front of you, sir?

18 A. Yes, I do.

19 Q. Now, we agree that the first person the accuser
20 sees after leaving the hotel room of Mr. Bryant is the night
21 auditor, correct?

22 MR. CRITTENDEN: Judge, I would object to
23 speculation as to that.

24 THE COURT: Well, I think it's a question. I
25 don't know what the answer is.

1 A. If I may finish reading?

2 Q. (By Mrs. Mackey) Absolutely.

3 THE COURT: Hold on for a second.

4 Okay. Go ahead

5 Q. Are you ready, Detective?

6 A. Yes.

7 Q. What the night auditor tells you through her
8 written statement is that the accuser was very excited that
9 Kobe Bryant was coming to the hotel, correct? That that was
10 her demeanor prior to the arrival?

11 A. Yes.

12 Q. And she tells you that after the accuser has shown
13 Mr. Bryant to his room and returns to the front desk area,
14 that the night auditor tells her, you know, you can leave
15 now, your shift's over, I've got it from here. Right?

16 MR. CRITTENDEN: Judge, I'm going to object. This
17 has nothing to do with the Court's previous ruling regarding
18 questions on demeanor. It is actually getting into hearsay,
19 double hearsay as well.

20 THE COURT: Well, I'm not sure it is double
21 hearsay, but --

22 MR. CRITTENDEN: She's asking the comments that
23 someone else made to her, that she then writes into a
24 letter --

25 THE COURT: I understand what you said. Okay.

1 MRS. MACKEY: Oh, I'm sorry. I didn't understand.
2 I got it.

3 THE COURT: That part of it I agree is double
4 hearsay.

5 MRS. MACKEY: That's fine, Judge.

6 THE COURT: The observations relative to demeanor
7 are what we spoke about. Let's limit it to that.

8 MRS. MACKEY: Right. Okay.

9 Q. (By Mrs. Mackey) She sees that the accuser stays
10 past her shift in order to give the tour to Mr. Bryant,
11 right?

12 MR. CRITTENDEN: Judge, again, I'm going to
13 object. That has nothing to do with demeanor.

14 THE COURT: Well, I think it's a preliminary
15 issue, but let's move it to that direction. Overruled.

16 Q. (By Mrs. Mackey) And she tells you that she sees
17 the accuser return from the tour with Mr. Bryant, correct?

18 MR. CRITTENDEN: Again, Judge, I'm going to object
19 as also mischaracterization of the actual evidence. She
20 didn't tell this detective anything. The detective received
21 a letter from this person, allegedly.

22 THE COURT: All right. Well, I think it's fairly
23 similar. But you may distinguish them even more carefully.

24 Q. (By Mrs. Mackey) In the letter she tells you
25 that -- I'm just going to go right to the letter here,

1 Judge -- that she -- that the accuser arrived back at the
2 desk after giving the tour, about 10 to 15 minutes later,
3 correct?

4 A. Yes.

5 Q. And that the night auditor asked the accuser to
6 please finish her cash sheet, correct?

7 MR. CRITTENDEN: Again, Judge. Objection. That
8 has nothing to do with demeanor.

9 MRS. MACKEY: I'm trying to get there, Judge.

10 THE COURT: Well, I do understand your concern,
11 but you have to get to someplace without -- so that there is
12 not -- the information that is being offered isn't
13 completely inaccurate.

14 MR. CRITTENDEN: Okay.

15 THE COURT: But I would like to move it on.

16 Q. (By Mrs. Mackey) Do you remember the question, or
17 do you want me to try it again?

18 A. Could you ask the question again, please.

19 Q. Sure. She asked her -- the night auditor asked
20 the accuser to please finish her cash sheet, correct?

21 A. Yes.

22 Q. And you understand that to be counting out her
23 drawer at the end of the night?

24 A. I presume so.

25 Q. And in fact, the accuser did that. She counted

PEOPLE V. HAMILTON

**CROSS EXAMINATION OF
DR. SUSAN VAN SCOYK
MAY 16, 1990**

1 (Court reconvened at 11:45 a.m., with all parties
2 present, and the following proceedings were held with the
3 jury present:)

4 THE COURT: Doctor, you may resume the stand and you
5 may bring in the jury.

6 Okay. Miss Mackey.

7 CROSS-EXAMINATION

8 BY MS. MACKEY:

9 Q Good morning, Dr. Van Scoyk?

10 A Good morning.

11 Q When you prepared the report in this case which is
12 dated April 17, 1989, you relied on essentially three bodies
13 of information as I understand your testimony. The statement
14 given to you orally by Officer Cavalli and Denise Haws?

15 A Correct.

16 Q Officer Cavalli's police report in this case?

17 A Correct.

18 Q And the March 1989 hospital evaluation?

19 A Correct.

20 Q Children's Hospital evaluation?

21 A That's correct.

22 Q And you also conducted a one-hour interview of
23 Candida Hamilton?

24 A Correct.

25 Q That was on April 11, 1989?

1 A That's correct.

2 Q Now, Doctor, you received this referral for the
3 evaluation of Candida Hamilton from the District Attorney's
4 office, correct?

5 A Well, we were contacted by Denise Haws, the
6 caseworker.

7 Q Doctor, do you have your report with you today?

8 A Yes.

9 Q Doctor, if you look at that report there's a heading
10 that says reason for referral?

11 A I see.

12 Q It specifically says that you were requested by the
13 District Attorney's office to interview Candida?

14 A That's correct. Well I see that Denise was one who
15 contacted us and also Mr. Cavalli spoke with us. Also, they
16 both came down to the interview.

17 That may be just a misunderstanding on my part given
18 the fact that at that point in time as far as I knew the
19 police were involved and the Social Services were involved,
20 so that's basically an error on my part.

21 I know down the road then certainly I was contacted
22 by the District Attorney's office but initially it was Denise
23 Haws and Mr. Cavalli.

24 Q So you're report is incorrect, correct?

25 A That one statement would be incorrect then at that

1 point in time, yes.

2 Q Your careful about preparing these reports.

3 A Well, usually. I mean we try to make them correct.

4 Q Through the statements of Chief Cavalli and Denise
5 Haws you had learned about Dr. Perna's physical exam of the
6 child?

7 A That's correct.

8 Q And you had learned that Dr. Perna found an enlarged
9 vaginal opening and some redness in the vaginal area?

10 A That's correct.

11 Q All also with those conversations with Chief Cavalli
12 and Denise Haws you learned that Candida had fabricated
13 stories in the past?

14 A There was mention. That again -- they never told me
15 what she had fabricated. They just said that they were
16 requesting an outside interview because they felt there would
17 be concerns that people would allege that Candy had
18 fabricated now.

19 I never did hear exactly what it was they were
20 concerned about that she had fabricated. I now understand
21 that most likely they were referring to earlier unfounded
22 allegations.

23 Q Specifically, Doctor, again, referring to your
24 report, if it would help you remember on the top of page two,
25 you said that the concerns of the District Attorney's office

1 were compounded by Candy's history of quote "fabricating
2 other stories" close quote.

3 MR. MICHAELSON: Your Honor, I object. I think this
4 is a mischaracterization. First of all, I don't see any
5 reference to the District Attorney's office in the paragraph,
6 and although I guess I can be corrected, I believe that
7 question has been asked and answered.

8 THE COURT: Well, is there or is there not a
9 reference to the District Attorney's office.

10 MS. MACKEY: Your Honor, I would be happy to read
11 the full paragraph if that would clear it clear it up.

12 THE COURT: You may.

13 MR. MICHAELSON: Excuse me, Judge, that is not
14 appropriate impeachment. She can show the document to the
15 Doctor who wrote this and ask her what it means, but if we're
16 going to be reading a report into the record we may as well
17 make it an exhibit

18 Q (Ms. Mackey) You have the report in front of you,
19 Doctor?

20 A Yes, I do.

21 Q My question to you is that you knew at the outset
22 that there were questions with regard to Candy's credibility.
23 And what those concerns were based in part on is her history
24 of -- and I'm using your language, her fabricating other
25 stories.

1 A That's correct. That was a concern related to us by
2 Denise that people were concerned that Candy could, in fact,
3 could fabricate stories. Again, she didn't offer examples.

4 I wasn't sure at the time what she was referring to
5 other than in the assessment of this case it would be an
6 important factor to keep in mind, that people would be
7 questioning that.

8 Q Now, in fact, Dr. Van Scoyk, when you talked to
9 Chief Cavalli, he told you specifically that there had been
10 prior reports made to Social Services through Candida's
11 mother and grandmother about prior sexual contact?

12 A I believe that's correct.

13 Q So you knew that she had a history of fabricating
14 stories and knew she had made prior statements about sexual
15 contact?

16 A I didn't know that she fabricated stories. I knew
17 people were concerned that she might. That was one issue to
18 be addressed in the report, just to clarify, and yes, I did
19 know that there was a history of prior concerns, allegations
20 whatever, of sexual abuses.

21 Q Now, Doctor when you are talking about the
22 assessment of children in general for substantiating whether
23 or not they have been sexually abused, you're talking about
24 children by and large who are in the normal range of
25 intelligence, correct?

1 A Not necessarily. I think there's a broad range of
2 the developmental concerns and issues for each particular
3 child that, you know come, to the situation.

4 It's not uncommon for children to have learning
5 disabilities, emotional disabilities, whatever, that fall
6 within the category of children who allege sexual abuse
7 so. . .

8 Q Doctor, I'm talking about the normal range of
9 intelligence, not emotional disturbance -- the normal range
10 of intelligence.

11 A Yeah, I would say that sort of bell-shaped curve
12 for, you know, normal intelligence would follow, you know,
13 the case we get for evaluation, so I think on that bell-
14 shaped curve, right, most kids have sort of normal-age
15 appropriate intelligence, then there is some that fall in on
16 the other end of the curve that have limited I.Q.
17 development.

18 Q When you are talking in general, Doctor, about these
19 studies that have been performed, they indeed follow that
20 bell-shaped curve, correct?

21 A Yes, I guess they would.

22 Q So the majority of the children that form the basis
23 for those reports are in the normal range of intelligence?

24 A That would probably be accurate, although I haven't
25 look at those statistics.

1 Q You agree with me on that, though?

2 A It makes sense.

3 Q And also with respect to the those studies that you
4 are relying on, you are dealing with children who are in the
5 -- that have age-appropriate knowledge of sex?

6 A You know, I guess, again, your logic of the bell-
7 shaped curve and where most kids fall, you know, would make
8 sense. I think that, you know, special attention is given,
9 though, in evaluating children with lesser abilities and how
10 do they fit into that spectrum as well.

11 Q I'm talking about in general, Doctor?

12 A That's fine.

13 Q And what you're basing your opinion on here in part
14 is studies that are done on the general population?

15 A To some extent, yes.

16 Q Okay. Thirdly, those studies are based on the fact
17 that the children that are studied are essentially truthful
18 about significant events such as sexual assault in their
19 lives?

20 A Maybe you can rephrase. I'm not quite sure.

21 Q In the studies to which you referred, there is an
22 assumption that children are essentially truthful about major
23 events in their life such as sexual assault?

24 A I'm not sure it's in the assumption. I think it's
25 one of the conclusions drawn from looking at children's

1 statements.

2 Q And finally, these studies are based again on the
3 bell curve and the children that are studied are essentially
4 within the normal range of emotional response and behavior?

5 A That makes sense. Logically that would be the case.

6 Q When you first interviewed Candy, you had access --
7 in fact, you had in your possession Dr. LaCross's report of
8 March 1989?

9 A That's correct.

10 Q And you saw from that report that Dr. LaCross had
11 done some psychological testing of Candida Hamilton?

12 A Correct.

13 Q Gave her four or five tests to test her
14 psychological profile?

15 A Yes.

16 Q And you saw that Dr. LaCross had had two interviews
17 with her?

18 A Correct.

19 Q And you saw that based on two interviews with the
20 child and that psychological testing she came to some
21 conclusions and, in fact, some specific diagnosis?

22 A That's correct.

23 Q Excuse me just a moment. And in that March
24 evaluation of Candida Hamilton, Dr. LaCross described Candida
25 as presenting herself with a cold, detached, cynical and

1 oppositional quality?

2 A That's what she described, yes.

3 Q That was much different from the child you saw?

4 A When I saw her, yeah, she presented much more in the
5 manner that I now see she presented earlier with Dr. LaCross.

6 Q In the December 1988 report that you received
7 later?

8 A Correct.

9 Q When you saw her, Doctor, she was giggling?

10 A Correct.

11 Q Enjoying playing the games?

12 A Correct.

13 Q And engaging in conversation with you?

14 A Yes, she did.

15 Q She also fidgeted and moved around a lot?

16 A Quite a bit; she was anxious.

17 Q That's quite different from the child that Dr.
18 LaCross described?

19 A At that point in time, yes.

20 Q Now, Doctor, you saw Candida Hamilton in April,
21 approximately three weeks after Easter where she claimed her
22 father hurt her?

23 A I think that's about right, the 28th to April 11.

24 Q And Dr. LaCross saw her before the Easter where she
25 claimed her father hurt her?

1 A That's correct.

2 Q She saw her in December of '88 and March 6th of
3 1989?

4 A Correct.

5 Q And when she saw her on March 6, her report shows
6 that she saw a child who was significantly emotionally
7 disturbed?

8 A Correct.

9 Q A child that referred to wanting to go puke in her
10 teacher's face?

11 A Correct. It's all in the report.

12 Q A child who claimed that her friend's mother was a
13 little whore?

14 A Correct.

15 Q Dr. LaCross described a child with a personality
16 disorder of wanting to get even with people with whom she was
17 in conflict?

18 A That's correct.

19 Q And she also described Candy wanting to prove her
20 competence to adults in her life?

21 A Yes, she did make that statement.

22 Q Dr. LaCross concluded, based on her interviews and
23 testing of the child that the prognosis for Candy was
24 extremely pessimistic?

25 A Yes, I recall reading that.

1 Q And that the likelihood of change was not very high?

2 A I recall reading that.

3 Q She also said that Candy appeared to be apparently
4 extremely stuck in an angry, hopeless position?

5 A Correct.

6 Q And then she made some specific diagnoses, Doctor,
7 and for that she used the DSM-3?

8 A That's correct.

9 Q And you're familiar with that?

10 A Yes, I am.

11 Q You use that in your work don't you?

12 A Yes.

13 Q Would you please tell the jury what the DSM-3 is?

14 A It's a compilation of the different acceptable
15 psychiatric diagnoses hopefully to differentiate diagnostic
16 diagnoses as well as hopefully give some standardization to
17 the treatment modes that are helpful with the different
18 diagnoses.

19 It's known to be somewhat weak in the area, however,
20 of child diagnoses. It's not its strong point, and the next
21 is the DSM-3R, which is the third one, revised. The fourth
22 one is about to come out, and it has, I think, a better area
23 for children.

24 Q But the DSM-3R is widely accepted?

25 A Oh, yes.

1 Q And you yourself do rely on it?

2 A Yes.

3 Q Now, actually, Doctor, the diagnosis that was given
4 by Dr. LaCross, is it called now a personality disorder not
5 otherwise specified?

6 A Correct.

7 Q And used to be called a mixed personality disorder?

8 A Correct.

9 Q And that that diagnosis is given when there's
10 features of more than one specific personality disorder
11 presented?

12 A That's correct.

13 Q For any one specific personality disorder not all of
14 the features are there?

15 A Correct.

16 Q But nevertheless the person that gives this
17 diagnosis sees a significant impairment because of the
18 personality disorder for social functioning?

19 A Correct.

20 Q Now, Dr. LaCross qualified that diagnosis with some
21 specific features of other personal disorders?

22 A Yes, she did.

23 Q You read those off to the jury. Specifically,
24 Doctor, looking at the antisocial personality disorder?

25 A Correct.

1 Q And now the essential features of anti-social
2 personality disorder are a pattern of irresponsible and anti-
3 social behaviors beginning in early childhood and continuing
4 into adulthood, correct?

5 A That's correct.

6 Q And typical childhood signs include lying, stealing,
7 truancy, vandalism, initiating fights, running away from home
8 and physical cruelty, correct?

9 A That's part of the diagnosis, right.

10 Q Furthermore, people with anti-social personality
11 disorder have no remorse about their effect on others, their
12 actions?

13 A I know you're reading from the manual so it's all
14 correct.

15 Q They may even feel justified in hurting or
16 mistreating others?

17 A That's correct.

18 Q So when Candy told the jury yesterday that she
19 fights with her teachers, and when you review the school
20 notes about how she fought with other children and with her
21 teachers, that is consistent with the typical childhood signs
22 of antisocial personality disorder?

23 A Yes, it is, but I think one of the problems with
24 that is that until a child becomes an adult you don't have
25 any way to see if these patterns of behavior happening now

1 are going to jell into or solidify into any anti-social
2 personality disorder, and in children what you use is the
3 diagnosis if those are the major traits that you are using to
4 make the diagnosis, you use the conduct disorder and the
5 conduct disorder is what you use with children who may or may
6 not develop anti-social personalities down the road, so I
7 think in fact it's incorrect to use the diagnosis of anti-
8 social personality disorder with a child.

9 In place of that you use a conduct disorder for
10 children, and I think the reason for that and the reason that
11 a child psychiatrist got involved with working on this manual
12 is that you can't transpose a lot of adult diagnoses down to
13 children because children are in different developmental
14 stages, so just to note that Candy hasn't had time for us to
15 determine, she may develop into an anti-social personality;
16 she may not. It's not really known.

17 Q It's particularly important in diagnosing an
18 antisocial personality disorder to know how the child behaved
19 before the age of fifteen?

20 A Yes, that's correct.

21 Q In fact, you can't even make that diagnosis unless
22 you know how the child behaved when she was a child?

23 A That's part of the criteria, correct.

24 Q Dr. LaCross also diagnosed Candy with a borderline
25 personality disorder. The essential feature of that disorder

1 is a pervasive pattern of instability, of self-image,
2 interpersonal relationships and mood?

3 A Correct.

4 Q And people with a borderline personality disorder
5 often have inappropriately intense anger?

6 A Correct.

7 Q They have recurrent suicidal threats, gestures, or
8 behaviors or other self-mutilating behaviors that are common.

9 MR. MICHAELSON: Excuse me, Judge, Miss Mackey is
10 reading a laundry list of diagnostic possibilities. The
11 DSM-3 is not described, does not describe for every patient
12 who is diagnosed every one of the possible criteria, and we
13 are being left with an impression of a child who is diagnosed
14 within a realm of one, probably they share every other
15 criteria and is taken out of context, and I think it's
16 inappropriately phrased, and that it is being taken out of
17 the context that it is meant to be in the book.

18 MS. MACKEY: Your Honor, just a few more questions
19 to Dr. Van Scoyk. We'll match it up as I did with the anti-
20 social behavior that these exact criteria have been observed
21 in Candida Hamilton.

22 MR. MICHAELSON: If they haven't been observed to or
23 a made of basis of this witness' foundation we're back in a
24 situation where Miss Mackey is asking this doctor to agree or
25 to disagree on the diagnosis based on someone else's

1 observations.

2 There is no foundation for the question at this
3 point in time unless this doctor, within the foundation of
4 her opinion, has been made aware of this some of this
5 information.

6 At this point we're far afield from the things as
7 far as I have heard as observed in this child. We're
8 speculating about what the child may have observed, may have
9 been seen doing by someone else.

10 MS. MACKEY: Your Honor, Dr. Van Scoyk testified
11 that this child has an extremely poor self-image. That is
12 within the specific criterias for borderline personality
13 disorders. She saw it herself. She testified to it.

14 THE COURT: This witness has been -- well, I guess I
15 don't know if did we accept her as an expert. I have a vague
16 feeling we have.

17 MS. MACKEY: Yes, Your Honor.

18 MR. MICHAELSON: She was qualified as an expert in
19 child psychiatry, Judge. It doesn't make it within her
20 opinion in this case to -- there is no foundation for the
21 question is my objection. I think Miss Mackey is asking this
22 witness to speculate about behavior this witness may not have
23 seen and has never seen in that report that specifically
24 states these behaviors exist.

25 If Miss Mackey can lay the foundation later, but

1 when we go through this laundry list of possible criteria for
2 diagnosis and ask a question, there is no foundation; there
3 is foundation this criteria applies to this child. There's
4 no foundation to say doesn't a child with this diagnosis
5 share all these criteria. That question would be
6 appropriate. It's the backward side of that I object to,
7 Judge.

8 THE COURT: Can't this witness answer a hypothetical
9 question based -- just so long as it's based on evidence even
10 if it's based on evidence that she knew at the time of her --

11 MR. MICHAELSON: It has to be evidence that is
12 likely to be admitted into the trial and relates to this
13 case, and I would submit the long laundry list of these
14 things, there is no evidence at all that is going to support
15 those criteria to match this child. Most of the them that do
16 certainly but the laundry list is too inconclusive, no
17 foundation to say it's an appropriate question for this
18 witness about this patient.

19 THE COURT: I haven't heard anything that I didn't
20 think there was some evidence in already about.

21 MR. MICHAELSON: Your Honor --

22 MS. MACKEY: Thank you, Your Honor.

23 MR. MICHAELSON: A quick response. One other
24 criteria is the child steals. I haven't heard anything about
25 the child stealing and I submitted five hundred pages of

1 discovery. I don't recall any in there either. That is one
2 example that comes to mind. The long laundry list doesn't
3 necessarily apply to this child.

4 MS. MACKEY: Dr. LaCross said that it did.

5 MR. MICHAELSON: Judge, why don't we call Dr.
6 LaCross and find out why she thinks that is not an
7 appropriate response. The foundation needs to be laid. We
8 can't pull this out of the thin blue air.

9 THE COURT: There certainly hasn't been evidence of
10 theft type behavior.

11 MS. MACKEY: I talked about lying and fighting and
12 there's been evidence to that, not stealing.

13 MR. MICHAELSON: Do we want to go line-by-line,
14 Judge? I want foundation, Judge. That is is my objection.

15 THE COURT: Okay. Let's phrase our question so that
16 it relates only to things that are in evidence or expected to
17 be in evidence.

18 Q (Ms. Mackey) Dr. Van Scoyk, you observed that
19 Candida had a poor self-image when you talked to her,
20 correct?

21 A That was somewhat evident.

22 Q That is one of the indicators of a borderline
23 personality disorder?

24 A I think given the state of mental health, you will
25 find that it's a criteria for numerous diagnoses, and not

1 exclusive of that. It's in the attention deficit disorders;
2 it's in depression; it's in post-traumatic stress disorders.
3 It's not in it and of itself a diagnoses of things.

4 Q It is consistent in the diagnosis of borderline
5 personality? The answer to that question was yes?

6 A Yes.

7 Q I wanted to make sure Mr. McDonald got that. You
8 were going to say?

9 A That again, along the lines of personality disorder,
10 borderline personality disorder being one, again, it's the
11 whole sense of the continuum of development, and the
12 borderline diagnosis is not routinely used on children.

13 In fact, in my training it has been that you don't
14 use a borderline diagnosis until someone reaches the age of
15 -- used to be 18, now I guess they say 15 or beyond.

16 It's another one where one has to be cautious not to
17 take an adult picture and impose it on the child.

18 Q In summary, Doctor, when you began your work with
19 Candida Hamilton in April of 1989 you knew that she had been
20 found by a licensed psychologist after an in-depth interview
21 and testing at Children's Hospital to be significantly
22 emotionally disturbed?

23 A Correct.

24 Q In addition, Doctor, you reviewed the school records
25 of Candida Hamilton for the three months prior to the claim

1 that she made against her father?

2 A Yes. Following my evaluation I did, yes.

3 Q But you are familiar with those?

4 A Yes.

5 Q In fact, you talked to Mr. Michaelson about those?

6 A Correct.

7 Q And you're aware after reviewing those records that
8 Candy expresses an intense dislike for her mother?

9 A Correct.

10 Q And in fact she says she hates her mother?

11 A Correct.

12 Q And that she thinks her mother hates her?

13 A That's correct.

14 Q You also note that Candy uses rather coarse
15 language, at times using the "F" word as the teacher
16 delicately puts it?

17 A Correct.

18 Q You also know that she has spit at her school mates?

19 A Correct. It's all in the report.

20 Q You know that long before March 26th that she was
21 grabbing school supplies and throwing them around the room?

22 A Correct.

23 Q Acting out aggressively and angrily?

24 A Correct.

25 Q You know that she was oftentimes -- and this is

1 before March 26 -- was given to loss of control and outbursts
2 in the school?

3 A Oh, correct.

4 Q Going back, Doctor, to what you knew before you
5 started the exam, you treated this case as one that had been
6 shown to have physical evidence to go along with Candy's
7 statements?

8 A That's correct.

9 Q And once again, to review, it was because you knew
10 that Dr. Perna said he found an enlarged vaginal opening and
11 some redness?

12 A That's correct.

13 Q And now, Doctor, you also know that Candy was found
14 masturbating the week before.

15 THE CLERK: Objection, Your Honor. That has been of
16 great dispute here, and the last time that was broached, the
17 witness who claimed that happened denied it. There is no
18 basis in fact for that, Judge, and I object to that question
19 on the same basis as before.

20 It's pure speculation, no foundation in fact for it
21 at this point in time.

22 THE COURT: Does the jury -- should the jury absent
23 itself for a minute?

24 MS. MACKEY: Your Honor, she's previously testified
25 that she knew about the masturbation. My question is did you

1 know about it and she's testified --

2 MR. MICHAELSON: Your Honor, we had better excuse
3 the jury. It's not of the record that I have --

4 THE COURT: Ladies and gentlemen, you may retire to
5 the jury room for a minute.

6 (The jury departed and a discussion was held on the
7 record not transcribed for the purposes of this record.)

8 THE COURT: You may bring in the jury.

9 (The following proceedings were held within the
10 presence and hearing of the jury:)

11 THE COURT: Ladies and gentlemen, the reference just
12 came up which I'm not going to repeat. It relates to
13 something about which no evidence has been presented. And
14 until there's evidence relating to that subject that you have
15 to just flat disregard it. If evidence comes in then you can
16 magically recall it, but you can't until then.

17 CROSS-EXAMINATION (RESUMED)

18 Q (Ms. Mackey) You know, Doctor, that small children
19 do masturbate?

20 A Correct.

21 Q And that masturbation can cause redness near the
22 vaginal area?

23 A Correct.

24 Q Did you do anything to ascertain whether Candida had
25 been masturbating prior to seeing Dr. Perna on March 26?

1 A I did not ask her directly. And I would suspect
2 most children do. I don't know to what extent she was or how
3 currently she was prior to the exam.

4 Q You didn't talk to Candida about that?

5 A No, I did not.

6 Q You didn't talk to anyone to find out whether or not
7 that happened?

8 A No.

9 Q Doctor, when you were dealing with Candida, you knew
10 at that time she had a borderline intelligence and low I.Q.

11 A That's according to the test, that was correct.

12 Q You accepted those results of the testing in your
13 report, didn't you?

14 A Yes.

15 Q And so you knew when you were examining Candida that
16 she didn't fall in the middle bell curve on those children
17 that had been studied with respect to her intelligence?

18 A Oh correct.

19 Q She was off on one end?

20 A Correct.

21 Q And once again, when you were examining Candida you
22 knew that she had a history of fabricating stories?

23 A I knew that was a concern. I didn't know of any
24 specific examples.

25 Q And you know that the general assumption is that

1 children don't lie?

2 A I think that is an assumption some people have. I
3 think there are differet understandings for that.

4 Q So you knew that Candida did not fall in that middle
5 range of children?

6 A Well, I don't want to follow that conclusion from
7 children. I don't think intelligence -- the I.Q. quotient
8 has anything to do really with any assessment of whether
9 children lie or not.

10 Q I'm not talking about that, Doctor, I'm talking
11 about the truthfulness of Candida.

12 A I'm sorry.

13 Q You knew -- let's just assume that the other people
14 were accurate in believing that Candida fabricated stories,
15 assume that is true. You know that that is not consistent
16 with children; generally, that children generally are assumed
17 to be telling the truth, especially about instances like
18 this?

19 A Well, I guess my problem in just answering that one
20 way or another, it's a more complicated picture than that.
21 So given that I can say that -- I mean -- I think children
22 lie about a lot of things. I mean, they lie to get how out
23 of trouble, you know, who spilled the milk or the cat did,
24 things like that, and I think that in general that you're
25 right.

1 The focus is traumatic events that are very highly
2 significant to children. They are not likely to lie about it
3 now, and I'm not sure what the statistics are on how much the
4 I.Q. or intelligence functioning of a child pertains to
5 recall of traumatic events. I don't know that.

6 Q You know that Candida said that her father touched
7 her sexually long before Easter; isn't that what we're
8 talking about here?

9 A I had heard there were previous allegations.

10 Q And when you asked her about that in your interviews
11 of her she said that nothing had ever happened to her before
12 Easter?

13 A She said, right, that nothing had happened like this
14 before.

15 Q This was the first time?

16 A You probably looked at the tape more recently than I
17 have.

18 Q Do you agree with me, Doctor?

19 A That was the sense I had, yes.

20 Q Okay. So when you were interviewing her, you knew
21 that she had made certain allegations and then denied them to
22 you?

23 A Well, I didn't know the specifics of the earlier
24 allegations. So I would say I didn't have a full picture of
25 that, but in my interview with her she denied that anything

1 prior to this had happened to her.

2 Q What did you do to find out what the prior
3 allegations were?

4 A You know, I talked with Detective Cavalli, and I
5 don't remember the specifics of the conversation or what the
6 specifics of those allegations were, you know, I think within
7 the context of this one particular incident and evaluation of
8 those prior allegations. I'm not -- well, obviously at that
9 point in time in my mind I didn't consider that they had a
10 significant amount of bearing on this particular assessment
11 and evaluation.

12 Q So you didn't care that the child had lied before?

13 A I wouldn't put it that way. I would say my
14 particular focus of this evaluation was this particular
15 allegation and this particular incident.

16 Q Doctor, when you're examining a child it's important
17 to know whether or not whether that child has been truthful
18 or untruthful in the past?

19 A That's correct.

20 Q And you examined Candy?

21 A That's correct.

22 Q But you didn't take into consideration that she had
23 been untruthful in the past?

24 A Well, again, I think it's a bigger picture than
25 untruthful or truthful. I think children -- and again I have

1 some objection to the phrase that children never lie -- I
2 think that makes the issue too black and white.

3 I think what you have to understand is that the
4 child's situation within their environment and what might --
5 what might motivate a child to either fabricate a story and
6 understand why they would do that or recant a statement they
7 made. It's very -- it happens a lot in children who make a
8 statement, make a disclosure and then during the
9 investigation or evaluation will retract that statement, and
10 there are a lot of issues in the family and the child's own
11 functioning that lead to them to recanting or retracting, and
12 that then the case comes and it's unfounded doesn't
13 necessarily mean that the child lied about it or that it was
14 a false allegation, so again, I'm just -- I don't know what
15 the situation was with Candy in those earlier allegations.

16 Q You did nothing to find out, did you?

17 A No, I didn't.

18 Q Let's talk about recantation. You said that
19 typically children will recant if they're fearful or in an
20 environment where they may get punished for saying what they
21 believe to be true?

22 A Those are some of the reasons, yes.

23 Q And that you won't see recantation as often when the
24 child is in a safer environment?

25 A That's correct, that's correct.

1 Q Doctor, hypothetically, with respect to a child who
2 is alleging sexual assault, it would be much easier for her
3 to make those allegations if she was not living with the
4 person she was accusing, correct?

5 A Again, it's a larger picture and there are a lot of
6 different variations to that.

7 Q But that's a safer environment when she was not
8 living with the person she's accusing.

9 A Oftentimes it is.

10 Q And it's a less safe environment when the child is
11 living with the person she's accusing?

12 A That would make sense, yes.

13 Q When you talked about the reliability of Candy's
14 statement, you talked about the consistency of the story over
15 time?

16 A That's correct.

17 Q Now, Doctor, when you were talking to Candida during
18 the videotape, you asked her if her mother knew about this,
19 didn't you?

20 A If you look at it, I probably did.

21 Q And she said, yes, that her mother did know about
22 it?

23 A Correct. I mean, if it's on the tape, I mean your
24 memory is probably fresher than mine for that.

25 Q And when you asked her what her mother had said

1 about it, she gave you absolutely no response, correct?

2 A If that's what is on the tape, correct.

3 Q Doctor, would you be surprised to learn that she
4 told the jury yesterday what she told her, the mother told
5 her, "You fucking bitch, go out and sit and freeze in the
6 car."

7 A Actually, it wouldn't surprise me.

8 Q She didn't tell you that?

9 A No, she didn't. But, again, I think in the context
10 of the dynamics and the understanding of Candy that that
11 would have to be a terribly embarrassing thing to disclose to
12 somebody you just met. I mean, it's a very sad thing for a
13 child to hear that from a parent, and so one way -- I don't
14 know -- but one way to understand her not telling me about it
15 was to save herself some embarrassment, and also it may have
16 been just too painful for her to deal with at that point
17 having have it happen very close to that time.

18 Q Another explanation, Doctor, is that she's mad at
19 her mother and she wanted to get even with her mother?

20 A That is certainly another explanation.

21 Q So she made that up for the jury?

22 A That's another explanation.

23 Q When you examine children of this age, it's
24 important to know the extent of their sexual knowledge,
25 correct?

1 A That's correct.

2 Q When you examined Candida Hamilton, did you know
3 that she had been shown anatomical dolls in May of 1988?

4 A No, I mean, I didn't know that specifically.

5 Q Did you ask anyone about that?

6 A No, I didn't have that information.

7 Q Anatomical dolls teach children about body parts
8 just by looking at them, don't they?

9 A They can, yes.

10 Q And you knew that the child had been taken to Social
11 Services without allegations of prior sexual contacts?

12 A Prior to this?

13 Q Prior to Easter of 1989.

14 A Yes, I understood that.

15 Q And that she had been examined by Dr. Perna
16 previously?

17 A Correct.

18 Q Now, it would be important to know, wouldn't it,
19 Doctor, that Dr. Perna had talked to the child in May of 1988
20 about penetration and asked her questions about penetration?

21 I mean, if he did, that's a source of sexual
22 knowledge, isn't it?

23 A That's correct.

24 Q If the child had been talked to about penetration by
25 a doctor then they know about it?

1 A That's correct.

2 Q Did you ask Dr. Perna whether he had ever talked to
3 the child about penetration?

4 A No, I did not.

5 Q And you yourself ask the child if she had ever seen
6 anybody have sex?

7 A Yes, I think that was the gist of the question.

8 Q She told you that she had observed her friend's
9 mother having sex with her boyfriend?

10 A I think she said that she had seen -- she said I saw
11 it at my friend's house. I don't believe she identified who
12 she saw.

13 Q Doctor, the jury heard that part of the tape
14 yesterday. And she said that "my friend's mother was always
15 doing it with her boyfriend. I saw it happen."

16 A Well, that would be accurate then.

17 Q And you didn't ask her any more questions about
18 that, did you?

19 A Not at the time, no.

20 Q But you didn't ask her what she had seen?

21 A No. I didn't pursue it. She look pretty agitated
22 and anxious already.

23 Q You didn't ask her what she learned about that?

24 A No, I didn't.

25 Q You didn't her ask her what her specific

1 observations were when she saw these people having sex?

2 A No.

3 Q Yet, Doctor, you're telling this jury that it's
4 important to know what the child's level of sexual knowledge
5 is in order to ascertain, in order to decide whether her
6 statements are reliable?

7 A Well, yes it is. And I think that part of that is
8 to assess if the child has been using more adult words or
9 more adult forms of understanding about sex and where they
10 could have been exposed to that information.

11 Q You didn't find out anything about this child's
12 prior sexual knowledge, did you?

13 A No, just from what she told me.

14 Q So when you examined this child, you knew you were
15 dealing with a significantly emotionally disturbed child
16 according to Children's Hospital?

17 A That's what the report stated, yes.

18 Q You discounted that because that's not what you saw?

19 A I wouldn't say I discounted that.

20 Q What would you say?

21 A I would say I took it into account, and I based my
22 assessment on my experience of Candy and my assessment of her
23 personally what I saw, how I saw her functioning that day was
24 perhaps one of her better days.

25 I don't know for what reason.

1 Q You didn't try to interview her later?

2 A No, I did not.

3 Q Even though you had seen a situation in which she
4 had presented quite differently to the same interviewer, Dr.
5 LaCross?

6 A Correct.

7 Q She had been one child in December and another child
8 in March?

9 A So it seems, correct.

10 Q You didn't do a second interview?

11 A No, I didn't.

12 Q And you knew that you had a child that had history
13 of fabricating stories?

14 A Again, I know that was a question. I don't know any
15 specifics about what she might have fabricated.

16 Q So you knew at least some people had decided you
17 were not dealing with a truthful child.

18 MR. MICHAELSON: Your Honor, I object. That's not
19 what has been presented in evidence.

20 THE COURT: Sustained.

21 Q ^{Ms. Markley}
~~(Mr. Michaelson)~~ You did nothing to find out about
22 the recent, the prior reports of sexual contact?

23 A I knew about them. I didn't know in particular
24 about them.

25 Q You didn't do anything to find out about it?

1 A No.

2 Q And all you found out about the sexual knowledge was
3 Candy herself?

4 A I guess that's correct.

5 Q You didn't do any more interviews or any more
6 research to find out what the child's sexual knowledge was?

7 MR. MICHAELSON: Asked and answered; going over the
8 same stuff for the second and third time.

9 THE COURT: Sustained.

10 Q (Ms. Mackey) Doctor, you come into this courtroom
11 today after reading a couple of reports and a one-hour
12 interview and tell this jury that what Candy said was
13 credible?

14 A In my experience Candy's statements, as I have said,
15 fall definitely within that range of children where we know
16 the case has been founded and that's my opinion.

17 Q And that's based on your careful, thorough
18 investigation?

19 A That's based on the investigation we did based on
20 the referral requests we had.

21 MS. MACKEY: No further questions.

22 (Redirect continued on next page.)

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CHAPTER IV:

**MASTERING APPELLATE STRATEGY:
PREPARING YOUR APPEAL
IN THE TRIAL COURT
AND
WINNING YOUR APPEAL
IN THE APPELLATE COURT**

By
Gregory E. Lucyk
and
David I. Bruck

**MASTERING APPELLATE STRATEGY:
PREPARING YOUR APPEAL IN THE TRIAL COURT AND
WINNING YOUR APPEAL IN THE APPELLATE COURT**

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I. WHY DEFENSE ATTORNEYS BECOME CYNICAL ABOUT APPELLATE REVIEW

A. How Our Experiences Mold Our Practices.

1. The client thinks, “If I lose, I can appeal!”
2. And we used to think that way too, when we were starting out . . .
3. Then we encountered reality:
 - a. Our client lost at trial, then held to have been “defaulted” on appeal,
 - b. Or the whole thing turned out to be “not an abuse of discretion,”
 - c. Or “harmless error,”
 - d. Or somehow not error at all.
4. Before long, criminal defense lawyers stop thinking about appeal: it’s a stacked deck. What’s the use? Better win at trial.
5. The result is that as a whole, the defense bar is much better at trying cases to juries and judges than at securing meaningful appellate review.
6. Okay, the deck really is stacked: “A criminal appeal is a mouse complaining to three cats about the cat down the street.” But we can do better, and we can make appellate review better.

II. IS ATTORNEY EFFECTIVENESS ON APPEAL A CONCERN?

Yes! 20% of all criminal appeals filed in the Supreme Court of Virginia (SCV) from the Court of Appeals of Virginia (CAV) in the October 2004 Session (46 out of 230) had procedural defects resulting in the case being dismissed or an issue rendered unreviewable at the appellate level.

<u># of cases defaulted</u>	<u>Problem</u>
7	- Appeal dismissed for improper assignments of error, untimely (or no) notice of appeal or a late petition.
20	- Issue waived, argument not made at trial.
7	- Issue waived, no objection at trial.
5	- Issue waived, no motion to strike.
3	- Issue waived, motion to strike not renewed.
4	- Issue unreviewable, transcript not filed or untimely filed.

Be warned! In both the SCV and the CAV, where attorney noncompliance with the Rules of the Court results in an appeal being dismissed, that attorney may be reported to the Virginia State Bar Disciplinary Board for such action as the Bar deems appropriate.

III. THE MOST RECURRING DEFAULT – EVEN THE BEST LAWYERS FALL SHORT IN PRESERVING THE ERROR FOR APPEAL

- A. This is Not Only a Problem for Beginners or Burn-Out Cases. When the Will is There, What Keeps us from Preserving the Record?
1. Fear. If you feel alone and out-of-place when you try to make the record, it's because you are. *And it's not because anything's wrong with you.* Making the record is where judicial impartiality tends to break down: you and your client are on one side, and the prosecutor and the judge are on the other. So relax and do your job.
 2. Overconfidence. You're an optimist, and that means you think you're going to win. If you're going to win, preserving the record won't matter.
 3. Put fear and overconfidence together, and it's easy to see why we

put our attention elsewhere: it's hard to preserve the record, it doesn't feel good when we're doing it, and anyway we don't really think that we'll need it when the trial is over.

B. Compensate for This by Structure. Making the Record and Trying a Case Require Two Different Levels of Consciousness.

1. *No one person* can do both jobs well at the same time. Get help.
2. The trial lawyer keeps his or her focus on the jury; co-counsel (the record lawyer) doesn't worry about the verdict, but only about what's going down on paper.

C. Dealing with the Hostile or Difficult Judge.

1. For a judge, dealing dispassionately with a lawyer who's laying the groundwork to get the judge reversed on appeal requires unusual equanimity. And not all judges have it.
2. Off-the-recordism. Resist pressure to go or remain off-the-record. There's no hard-and-fast rule about unrecorded in-chambers discussions, but if the judge steers you in there, make sure that a full summary of what happened there gets placed on the record as soon as you get back to the courtroom and the court reporter.
3. Intimidation. Insecure judges sometimes show insecurity by anger.
 - a. The magic words: MAY I BE HEARD?
 - b. When the answer is "NO!" make written proffers.
 - c. This is when you MUST have someone helping you keep track of what is and isn't already in the record.
 - d. The judge's tone of voice is never in the record unless you put it there. Move to admit the back-up tape recording; describe what you (and the jury) have been hearing.
4. Know when you've reached your limit: an intimidated lawyer is not an effective lawyer. ONLY YOU know when you're intimidated.
 - a. Move to withdraw; place your reasons on the record.
 - b. Written basis for motion can be less inflammatory.

IV. TECHNIQUES FOR PRESERVING ERROR IN THE TRIAL COURT

A. Cardinal Rule:

An issue, objection or argument not made in the trial court cannot be raised for the first time on appeal. Rules 5A:18; 5:25. *Buck v. Commonwealth*, 247 Va. 449, 443 S.E.2d 414 (1994).

There is an “ends of justice” exception to the procedural default rule, but it is very narrowly and rarely applied. To come under the ends of justice exception, the record must affirmatively show that some element of the criminal offense did not occur, or that the conduct proved does not amount to a criminal offense. Although not employed often, the CAV also recognizes a “good cause” exception that is distinct from the “ends of justice” exception. *Campbell v. Commonwealth*, 14 Va. App. 988, 995-96, 421 S.E.2d 652, 656-57 (1992) (Barrow, J., concurring).

In the SCV, the ends of justice has been applied in a criminal case only two times in the last 25 years. *Jimenez v. Commonwealth*, 241 Va. 244, 402 S.E.2d 678 (1991) (where a complete absence of proof and no jury instruction on an essential element of the crime was such that defendant was convicted of a “non-offense”); *Ball v. Commonwealth*, 221 Va. 754, 273 S.E.2d 790 (1981)(capital murder conviction reversed where the evidence proved no more than felony murder, i.e., the killing occurred during an attempted robbery, and not an actual robbery. Defendant was “convicted of a crime of which under the evidence he could not properly be found guilty”).

B. How Do You Preserve Issues for Appeal?

1. By Objection!

- a. Note your objection. Make sure you state all potential grounds for your objection. You really only have to object once - on the record. Code § 8.01-384 provides that “[n]o party, after having made an objection or motion known to the court, shall be required to make such objection or motion again in order to preserve his right to appeal . . .” *King v. Commonwealth*, 264 Va. 576, 570 S.E.2d 863 (2002) (where a party clearly objected to a specific ruling of the trial court, the error is not waived even if the party failed to object to a jury instruction applying or implementing the trial court’s prior ruling).
- b. When to object? You should object to improper evidence, testimony or argument at the time it is offered. Ask for a mistrial and a cautionary instruction in order to preserve the

issue for appeal. Note: It is not enough to say “that’s grounds for a mistrial.” You must actually make the motion.

- c. Obtain a ruling. Make sure the court rules on your motion or objection. *Fisher v. Commonwealth*, 16 Va. App. 447, 431 S.E.2d 886 (1993) (defendant “failed to obtain a ruling from the [trial] court. He requested no relief. Because he was denied nothing by the trial court, there is no ruling for us to review”).

2. Use a Motion to Preserve the Error.

- a. Motion in Limine. Make a pre-trial motion to exclude some or all of any documentary or testimonial evidence; anticipated improper argument; or to challenge the qualifications or testimony of an expert.
- b. Motion to Strike. In order to challenge the sufficiency of the evidence, you must make a motion to strike at the close of the Commonwealth’s evidence, and again at the end of all the evidence. The motion must be specific, and only those reasons outlined in the motion may be grounds for an appeal. *Redman v. Commonwealth*, 25 Va. App. 215, 487 S.E.2d 269 (1997). The CAV recognizes that in a bench trial, a motion to strike at the conclusion of the evidence may be folded into the argument in summation. *Campbell v. Commonwealth*, 12 Va. App. 476, 405 S.E.2d 1 (1991).
- c. Motion to Set Aside. You may also challenge sufficiency by a motion to set aside the verdict. Even if no motion to strike was made at trial, the motion to set aside preserves the sufficiency issue for appeal. Note, however, that objections to testimony, erroneous jury instructions and other matters that could have been cured by the court during trial cannot be preserved for appeal by means of a motion to set aside. *Spitzli v. Minson*, 231 Va. 12, 341 S.E.2d 170 (1986); *Ryan v. Commonwealth*, 219 Va. 439, 247 S.E.2d 698 (1978).

3. Other techniques for preserving error.

- a. Proffers. If your witness is excluded from testifying, or parts of his or her testimony are excluded, you must proffer the testimony on the record (either summarized by counsel,

providing the other side does not object, or better, by examining the witness on the record without the jury).

- b. Jury Instructions. If your proposed jury instruction is refused, make sure it is entered into the record marked “denied.” If the rejected instruction is not in the record, that issue will be waived on appeal.
 - c. Voir Dire Rulings. If you have been denied the opportunity to ask questions to a juror or the panel, you must object to the seating of that juror or panel. *Spencer v. Commonwealth*, 238 Va. 295, 384 S.E.2d 785 (1989), *cert. denied*, 493 U.S. 1093 (1990).
4. Avoid Waiving Your Objection by Later Actions. If you unsuccessfully object to the introduction of certain evidence by the Commonwealth that you consider improper, and then later, on your own behalf, introduce evidence of the same character, you will waive your objection to the Commonwealth’s evidence. *Saunders v. Commonwealth*, 211 Va. 399, 401, 177 S.E.2d 637, 638 (1970).

V. PLANNING THE APPEAL BEFORE TRIAL

A. From Trial to Appeal.

- 1. Some of what goes wrong in a criminal trial happens without warning. But a lot of what goes wrong can be foreseen, and planned for.

B. Trial Notebook.

- 1. Pretrial motions
- 2. Evidentiary Issues
- 3. Offers of proof
- 4. Witnesses in support of motions and objections
- 5. Reminders to renew objections and request additional relief at key stages:
 - a. before the jury is sworn,
 - b. at the end of the Commonwealth’s case,

- c. after closing argument,
 - d. before and after jury instructions,
 - e. after the verdict.
6. Page of legal issues for appeal, including each arguable constitutional rationale, identified before trial.

C. Don't Mistake Quantity for Effectiveness.

Carrying on like you're preserving an issue (by means of long drawn-out legal argument) and actually preserving it are two very different things). . .

Okay, now you've lost and you actually have to appeal.

VI. THE SEVEN DEADLY SINS OF APPELLATE PRACTICE

Errors that are guaranteed to result in dismissal of an appeal or waiver of a claim.

- 1) Failure to preserve your issue for appeal (See Section IV).
- 2) Failure to timely file a Notice of Appeal.
- 3) Failure to timely file a Petition for Appeal.
- 4) Failure to file, or to timely file, a transcript or written statement of facts.
- 5) Failure to include "Assignments of Error" in the SCV, or "Questions Presented" in the CAV.
- 6) Failure to include, in SCV appeals, the "Constitutional Issue/Precedential Value" statement required by Code § 17.1-410 in misdemeanor cases "where no incarceration is imposed."
- 7) Failure to timely respond to a "10 Day Letter" from the Clerk of the CAV.

VII. KNOW YOUR DEADLINES; TIMELY FILE NOTICES AND PETITIONS

The Rules of the SCV and the CAV establish specific deadlines for filing the Notice of Appeal and Petition for Appeal in order to initiate proceedings in those Courts. Rules 5A:6, 5A:12 (CAV); Rules 5:9, 5:14, 5:17 (SCV). The notice or petition must be received in the Clerk's office by the deadline. Strict compliance is required, and if the

notice or petition is filed even one day late, the rule is violated and the appeal will be dismissed.

A. Registered/Certified Mail Exception for Receipt by the Clerk.

Both the CAV and the SCV have rules providing that a paper is timely filed in their Clerks' offices if it is postmarked and deposited in the mail by the due date, and it is sent by "registered or certified mail." Rule 5A:3(c)(CAV), Rule 5:5(b)(SCV). Note that the rule is specific as to allowable mailing processes. If you send your papers by Federal Express, or Priority Mail, or any other delivery method, the exception will not apply, and the pleadings must arrive in the Clerk's office by the due date.

B. Practice Tip for Appeals from the CAV to the SCV:

Bear in mind that your appeal clock from the CAV to the SCV begins running from the date of the denial of the petition by a three-judge panel. Do not ask for a rehearing from the denial by the three-judge panel. The CAV will not entertain further pleadings at that stage – the appeals clock will not be tolled, and if you wait for another order denying rehearing, your 30 days to file the notice of appeal and petition for appeal in the SCV will expire. Most likely, your appeal to the Supreme Court will be defaulted, and your name will be added to the Court's list of attorneys in error.

VIII. COUNSEL MUST PROVIDE A COMPLETE RECORD FOR APPEAL

Appellant's attorney must ensure that the record contains transcripts or a written statement of facts necessary to permit resolution of appellate issues. *Commonwealth v. Williams*, 262 Va. 661, 553 S.E.2d 760 (2001); Rules 5A:8(a)(b), 5:11(a)(b) (the transcript "is a part of the record when it is filed in the office of the clerk of the trial court within 60 days after entry of the final judgment"). If the transcript is filed even one day late, the rule is violated and the appeal will be dismissed.

A. Proofread the Transcript.

Take the time to ensure the transcript accurately reflects the proceedings. Make certain that all phases of the trial are transcribed and filed in the record. Is your motion to strike transcribed? If you had a pre-trial motion in limine or motion to suppress, a side bar conference over an objection, or an argument in chambers concerning jury instructions, confirm that those proceedings are included in the transcript.

B. Practice Tip:

During the trial, keep an eye on the Court Reporter. If you “approach the bench” to discuss an objection, make sure the Court Reporter is taking it down. If the transcript says “Proceedings not Recorded,” and there’s no argument or ruling in the record, the issue will be waived. This happens frequently. Be aware!

C. Practice Tip:

Keep in touch with the Court Reporter after the final order to make sure the transcripts will be timely completed. Remember that any Reporter’s delay will be attributed to counsel, who remains the “Captain of the Ship.” If you believe the transcripts may be delayed, file a Motion for Extension of Time to File Transcripts with the appellate court, before the deadline expires. Rule 5A:8(a)(CAV); Rule 5:5(a)(SCV).

IX. PAY ATTENTION TO YOUR ASSIGNMENTS OF ERROR/QUESTIONS PRESENTED

A. Supreme Court of Virginia Rule.

Rule 5:17(c) provides, in pertinent part:

“(c) Form and Content – Under a separate heading entitled “Assignments of Error,” the petition shall list the specific errors in the rulings below upon which the appellant intends to rely. Only errors assigned in the petition for appeal will be noticed by this Court. Where appeal is taken from a judgment of the Court of Appeals, only assignments of error relating to questions presented in, or to actions taken by, the Court of Appeals may be included in the petition for appeal to this Court. An assignment of error which merely states that the judgment or award is contrary to the law and the evidence is not sufficient. If the petition for appeal does not contain assignments of error, the appeal will be dismissed.”

A proper assignment of error will set forth clearly, concisely and with reasonable certainty the “specific errors” in “the rulings below” upon which the appellant intends to ask for a reversal of the judgment. The appellate court will not hunt through the record for every conceivable error that the lower court may have committed. Counsel must “lay his finger on the error.” *First National Bank v. Trigg*, 106 Va. 327, 342, 56 S.E. 158, 163 (1907). The same principles apply to “Questions Presented” in the CAV. Rules 5A:12(c), 5A:20(c).

Examples:

1. The trial court erred in entering judgment against the defendant upon insufficient evidence. [Inadequate, may result in dismissal. A/E should specify how the evidence was insufficient].
2. The trial court erred in entering judgment against the defendant where the evidence was insufficient to prove that a “breaking” occurred within the meaning of the statute. [Adequate A/E – error spelled out concisely and with specificity].

B. Practice Tip:

If the Court of Appeals has refused to review an issue on procedural default grounds, and you think that the CAV was wrong (i.e., the CAV erred in finding that the issue was not preserved, or erred in failing to apply the “ends of justice” exception), then you must add this as a separate assignment of error in your appeal to the SCV.

C. Practice Tip:

If your appeal is granted by the SCV, don’t try to change or embellish your assignments of error in the merits brief. The Court will disallow any allegations of error or contentions not asserted in the petition for appeal.

X. BE AWARE OF CODE § 17.1-410

Code § 17.1-410 provides that the decision of the Court of Appeals is final in cases, among others, involving traffic infractions or misdemeanor convictions where no term of incarceration is imposed. In these cases, you still may appeal to the SCV, but you must include a statement in the petition for appeal to the SCV stating why the decision of the CAV involves (1) a substantial constitutional question as a determinative issue, or (2) matters of significant precedential value.

Other criminal appeals do not require this statement. However, if the statement is not included in a traffic case, or a misdemeanor where no incarceration is imposed, the SCV will dismiss the appeal.

XI. PROMPTLY REPLY TO ANY “10 DAY LETTER” FROM THE CLERK

The Clerk of the CAV ordinarily will notify counsel by letter if there is a question about the filing fee or indigency status of the appellant at the time of the filing of a Notice of Appeal. This “10 day letter” is sent most frequently when the filing fee is not included with the Notice of Appeal filed with the Clerk of the CAV, or if the certificate in the notice fails to specify whether counsel is “appointed or privately retained.” Rule 5A:6(c), (d)(3). Counsel must reply to the letter within 10 days, addressing the inquiry, or the

petition for appeal “shall be dismissed.” If this occurs, and a Petition for Rehearing is not successful, counsel will have defaulted the appeal.

XII. AVOIDING THE VENIAL SINS OF APPELLATE PRACTICE

Some transgressions may not result in your appeal being dismissed or certain issues left unheard, but may undermine your credibility and the effective representation of your client.

A. Here are a Few Venial Sins to Avoid.

1. Don’t overwhelm the appellate court with claims. Choose the strongest issues to emphasize. Remember that while the decision whether to appeal belongs to the client, *Miles v. Sheriff*, 266 Va. 110, 581 S.E.2d 191 (2003), the decision of what issues to appeal belongs to the lawyer, *Jones v. Barnes*, 463 U.S. 745 (1983). As Justice Robert Jackson once said: “The mind of an appellate judge is habitually receptive to the suggestion that a lower court committed an error. But receptiveness declines as the number of assigned errors increases. . . Experience on the bench convinces me that multiplying assignments of error will weaken a good case and will not save a bad one.” *Jones*, at 752, quoting Jackson, “Advocacy Before the United States Supreme Court,” 25 TEMPLE L.Q. 115, 119 (1951).
2. Do not misstate or distort the facts of your case, either in your brief or the oral argument. Omitting key facts destroys your credibility, particularly when they are pointed out by Court Staff or the other side. You serve your client and yourself better by maintaining your own credibility. Don’t ignore unfavorable facts. Refer to them in a way that does the least harm.
3. Do not file a petition or brief without proofreading the document carefully at least one time. You do not want to be remembered as the lawyer who cited to “Mickey’s Jurisprudence.”
4. In oral argument, don’t evade, dodge or dance around a question from the Court. It might be a friendly question, an unfriendly question, or a neutral question. Sometimes it’s hard to tell. The Justice might be trying to make up his or her own mind. Answer the question directly and concisely, and then explain your answer if necessary. Justices ask hypothetical questions because sometimes they are concerned about how a decision may affect other situations. Don’t say, “That’s not my case.” They already know that. If you don’t know the answer to the question, say so.

Remember that the Justice asking the question isn't the only audience for your answer.

5. Don't attack opposing counsel. Drop the hyperbole, and remember that cheap shots at the other side will only hurt your case.

XIII. CONCLUSION

A. THE APPEALS THAT WIN.

1. Make your case unusual.
2. An appeal that lacks historic significance is much more likely to be won.
3. "Most cats are nice to us mice, which is what makes this one unfortunate incident so troubling, Your Honor."
4. But it's the accretion of such small claims and small victories that tame the power of the state over the individual, and give vitality to due process of law.

CHAPTER V:

SEEING IS BELIEVING: PERSUASION AND DEMONSTRATIVE EVIDENCE FOR THE NEW MILLENNIUM

By

Randi McGinn



**PERSUASION AND DEMONSTRATIVE EVIDENCE
FOR THE NEW MILLENNIUM**

**Supreme Court of Virginia and Virginia State Bar
Indigent Defense Training Seminar**

**May 20, 2005
Richmond, Virginia**

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Have you ever been arguing in front of a jury – you know, really firing on all cylinders with the oratorical devices and the passion of Martin Luther King, Jr. – when you look up from your notes to find that half the jury is asleep and the other half are busily weaving nooses out of their ties? I can relate...I've been there too.

What is going on here? We're doing all the right stuff. Our voices ringing through courtroom like the sword of justice, loud and righteous like a preacher when talking about the wrong-doing of the evil corporation, going all soft and mushy when we place our hands on the client's shoulders, with moments of worshipful silence to let it all sink in. And still, we're losing our audience. Alas, we lawyers are **people of the book** or **people of the word** and our jurors, increasingly, are **people of the screen**.

Although most of us are good story-tellers, lawyers are behind the rest of society in understanding the importance of presenting information visually. Schooled in the tradition of roof-raising oratory, we talk...and talk...and talk. And although we have learned to talk well and with feeling, we can no longer hold the jury's attention for a half hour (much less a whole trial), without giving them something interesting to see.

Modern jurors, not just Gen X'ers anymore, but **all** of them, learn through their eyes, not their ears. They are used to receiving information in small bits and, because of TV, have very short attention spans. If you are not doing something visually to convey your theories, themes and your story throughout the case, you will lose the jury approximately five minutes into any long oratory. Not convinced? Try these statistics:

- **75% of What We Learn is Acquired Visually Only**
- **Only 10% of Information Delivered Verbally is Remembered after 3 Days**
- **65% of Information Delivered Visually and Verbally is Remembered after 3 Days**
- **The Combination of Visual and Verbal Communication is 6 Times More Effective than Verbal Delivery Alone**

Add to that the cynicism of the modern juror who, by age 21, has been overexposed to approximately 500,000 advertisements trying to sell something. Our jurors walk into the courtroom with the certain knowledge that people trying

to sell you something LIE. Much worse, it is a dreaded criminal defense lawyer (whose job they've been wrongly taught, is to obscure truth and "get the client off" at all costs) who is about to sell them something. Before you utter one word, they have covered their ears and steeled themselves against whatever theory you are trying to sell them about your case. Although their ears may be closed, they can't close their eyes (except in Texas), or the judge will try to wake them up and make them listen.

What kinds of things can you use to help the people of the screen learn your case? There are exhibits you cut and paste, ones you have professionals make and, increasingly, through technology, sophisticated exhibits you can create and project and/or print as exhibits from computer programs.

I. EXHIBITS FOR HEARINGS AND TRIAL

A. Diagrams

Diagrams are most often used to show the layout or overview of the scene of a collision or the area where the injuries occurred. It can be used to illustrate obstructions to observation, cross-examine witnesses on inconsistencies or explain your client's version of events.

Probably the most important thing to remember about the use of diagrams, is to never use a diagram with your own witness for the first time on the stand. Always show your witness the diagram in advance and have them draw on a sample diagram the same items which you will have them sketch at trial. When using diagrams, keep the following in mind:

1. Make them as simple as possible so they focus attention on the point you intend to make (e.g., the building that was between the defense's "eye witness" and your client at the time he claimed he saw the red light.).
2. Make them as close to scale as possible to avoid objections.
3. Use properly sized cutouts whenever possible to avoid your witness making mistakes.
4. Use overlays
 - a. to keep the other side from scribbling all over your masterpiece

- b. for use on cross-examination, so new witness will not see where previous witnesses have located key pieces of evidence.

B. Photographs

Photographs can be used to show the scene, the vantage point of the witnesses, lighting conditions, obstructions to vision, the destruction of your client's vehicle and the force applied to the frail human bodies inside the vehicle.

When using photographs, present the photograph in a size large enough for the jury to see the important details. These can be presented in a variety of ways:

1. Single or multiple 8x10 photographs on a poster.
2. Photograph enlargements (16x20 color or 30x40 black and white).
3. Laser enlargements from a photograph – less expensive and can be blown up to a fairly large size without much loss of definition.
4. **Best of all** - Scan into your computer and project on a screen – the size of which is only limited by the size of the courtroom wall or screen.

C. Charts and Blow-ups

The use of charts and blow-ups is limited only by your own imagination. These charts can be used in opening statements, summation or during hearings or trial.

Consider the following:

1. Chronological summary or time line of case or events.
2. Enlargements of impeaching or contradictory portions of documents or prior witness statements.
3. One word or phrase which is crucial to your defense.
4. Blow-ups of jury instructions or portions of instructions.
5. Call outs of important portions of lengthy documents.

6. Questions you want the jury to ask.

D. Models and Toys

Models and toys are inexpensive ways to recreate a scene in a three-dimensional fashion for the jury. Trucks, houses, planes, trees, human figures and police cars can be purchased at your local toy store for use in demonstrating how something happened. You can often find the same color and model vehicles that were involved in your case. For more complicated cases you can make your own models or have them custom made through various commercial outlets.

E. The Thing Itself

Subpoenaing or bringing into or outside the courtroom the actual objects involved in your case creates drama and interest in the courtroom. Some suggestions:

1. The actual highway signs or barricades that should have been posted or in place at the scene of a collision. The signs we see on the roadway as we whiz by in our cars are huge inside a courtroom.
2. The totalled vehicle in which your clients were traveling. These can be towed to a spot outside the courtroom for a brief view by the jury during the trial.
3. The weapons, flashbang grenades, battering rams or other items carried by police officers when raiding a house where they committed civil rights violations upon your client.
4. The security devices (steel doors, personal panic alarms, video cameras) that should have been present in a convenience store to prevent criminals from attacking customers or late night workers.
5. A mock-up warning that should have been on a defective product.
6. The machines that were used in the hospital to keep your client alive.

F. Videotape and Tape Recordings

Law enforcement officers are routinely bringing along video cameras or tape recorders for surveillance, raids, arrests and sometimes collisions. These tapes can often provide helpful information.

If there has been television coverage of a collision or area where an injury occurred, subpoena or obtain the media's video footage of the area. This must be done quickly before this footage is destroyed.

The advent of inexpensive and easy-to-operate video cameras and the ability to rent these video cameras, now makes it a relatively inexpensive process to obtain your own video footage of the scene. Consider the following:

1. A video walk around the area, showing lighting and general layout.
2. Video from a drivers or witness' point of view, including any obstructions to his/her vision.
3. Recreations of events.
4. Footage of how a particular medical procedure should have been performed.
5. Video footage of the cycling of a stop light at the intersection where a collision occurred.

G. Jury Views

Sometimes the best evidence of an occurrence can only be obtained by having the judge or jury view the scene. For the best hope of success, file your motion long before the morning of trial. Offer to make arrangements for jury transportation. Always have a videotape of the area as a backup if your motion is denied.

II. COMPUTER GENERATED EXHIBITS

If you could do anything you wanted in the courtroom to convey information in the most effective way possible, what would it be? Kansas City lawyer Joe Johnson claims he would use back-up singers, ala the Supremes. I would hire the best director Hollywood had to offer, the best scriptwriter and the most appealing actors possible and would create a movie reflecting what really happened to my client. Impossible, you say? With the technology now available for courtroom use, you can come pretty close.

A. Microsoft Powerpoint and Corel Presentations

One of the easiest programs to learn and use yourself (without having to hire a computer expert to do it for you) is Microsoft Powerpoint (its counterpart is Corel Presentations). This program may already be on your computer if you have installed the Microsoft Office Suite of software. It is simply a slide show, in which you can place scanned photographs, videotape or create diagrams, timelines and other documents. All of these items can be animated, by selecting from the menu how you wish the words or call outs to move.

If you are computer-phobic, sign up for a half-day class to get you started using this program. If you are not afraid to jump in and learn how, see the attached brief guidelines from Allegra Carpenter or Powerpoint for Dummies or Powerpoint for Litigators with CD rom from www.NITA.org.

If the need to be a more effective communicator is not enough motivation for you to learn this stuff, then perhaps you should know that insurance defense attorneys around the country are catching onto the power of this technology and are learning Powerpoint for use against your clients. If insurance defense lawyers can learn this technology, then so can you.

a.) Basics you need

- 1.) Laptop or other computer to take to courtroom – Pentium chip or higher**
- 2.) Scanner**
- 3.) Way to project:**
 - a.) Projector and screen**
 - b.) Television or computer monitors for jury**

b.) Getting the Court to Allow it

- 1.) Notice to court and opposing counsel**
- 2.) Evidence –**
 - Stipulate to those prosecution exhibits you will need for your presentation
 - Find out if the court will allow you to show the jury anything you think in good faith will come in as evidence at trial or only those exhibits that have been agreed upon by the parties.

3.) Arguments for allowing it:

- Its faster – visual presentation means less oral explanation
- Diagrams only better and faster
- Nothing more than you could do with a pen and pad
- It's most effective way to present argument and the accused has a right to effective representation

4.) What you have to show them

So far, no one on the other side has asked to see my Powerpoint presentation for opening statement. However, as lawyers become more sophisticated, expect them to request a preview of your opening statement before it occurs. Since what you put together is essentially your notes and outline for opening, I would object to being required to show them the whole thing. Doing so would give an unfair advantage to the other side, since they will know your themes, etc., in advance. Instead, offer to identify those stipulated exhibits or photos which you intend to use and any scene diagrams or possibly timelines you've created. Just as you wouldn't have to reveal your argument or the order of your argument, you should not have to reveal the order of your presentation. **If the other side is using Powerpoint, you should ask to see the same things they ask of you.**

5.) Preserving the record on appeal and having back up

Remember – when using technology, anything that can go wrong, will. Have your presentations on disk, which can be offered to the court for the record after your presentation. Have a back up computer to use in case yours goes ballistic. Know how to fix things or have someone in the courtroom with you who can troubleshoot computers.

Attached to this summary are samples of various computer programs [Microsoft Paint, architectural renderings, Powerpoint, Auto CAD renderings] which might give you some ideas for visual aids you can use in your case.

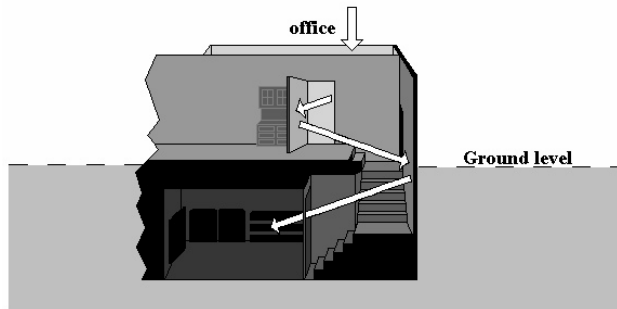
I. THE CHEAPEST AND EASIEST GRAPHICS PROGRAM ON THE PLANET –
MICROSOFT "PAINT"

A. IF YOU HAVE WINDOWS, YOU HAVE "PAINT"

i. Start / Programs / Accessories / Paint



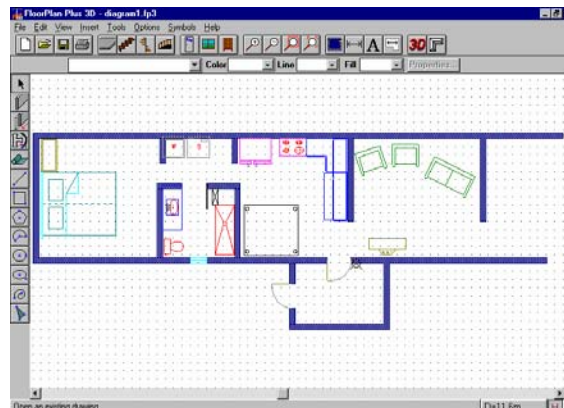
ii. "Paint" Has It's Limitations, But is Very Easy to Understand. It's Just Like Drawing On Paper. This Diagram Was Created In "Paint":



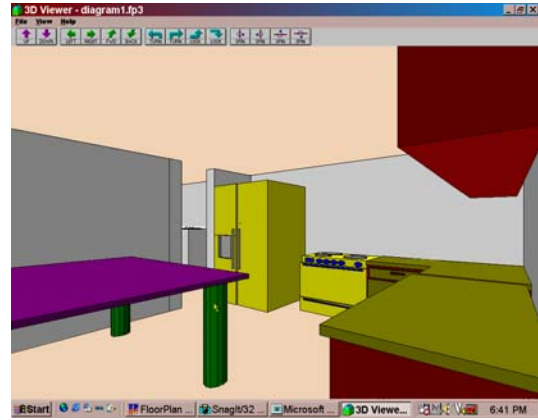
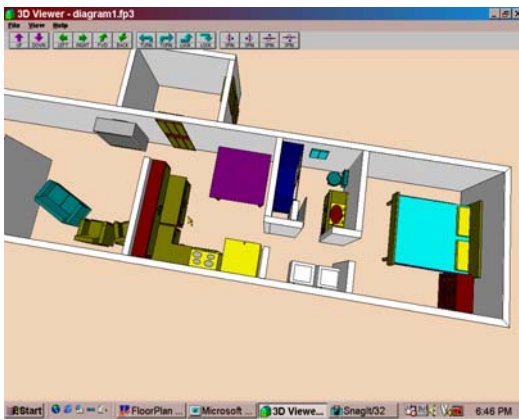
II. OLD ARCHITECTURE/HOME DESIGN PROGRAMS ARE EASY TO FIND ON THE CHEAP, ARE EASY TO USE, AND CAN DEMONSTRATE PERSPECTIVES TO THE JURY

A. For Example, I found **IMSI's "FloorPlan 3D"** for about \$10.00 on the computer software sale rack

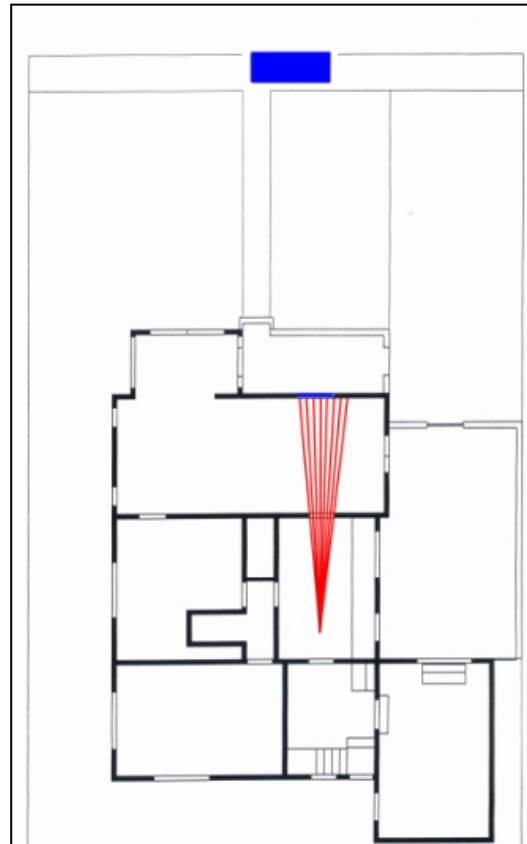
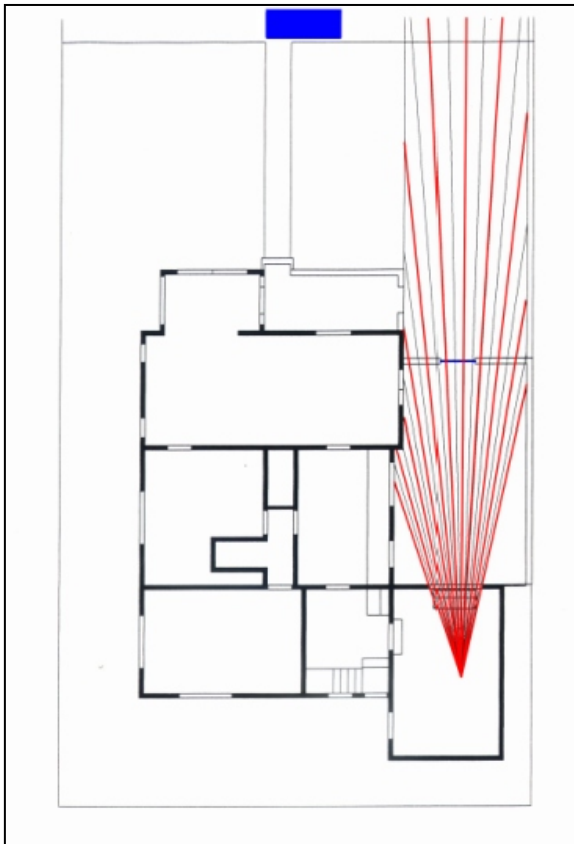
i. Install Program and Draw a 2D Diagram.



iii. You can create 3-D and 3-D birds-eye views:

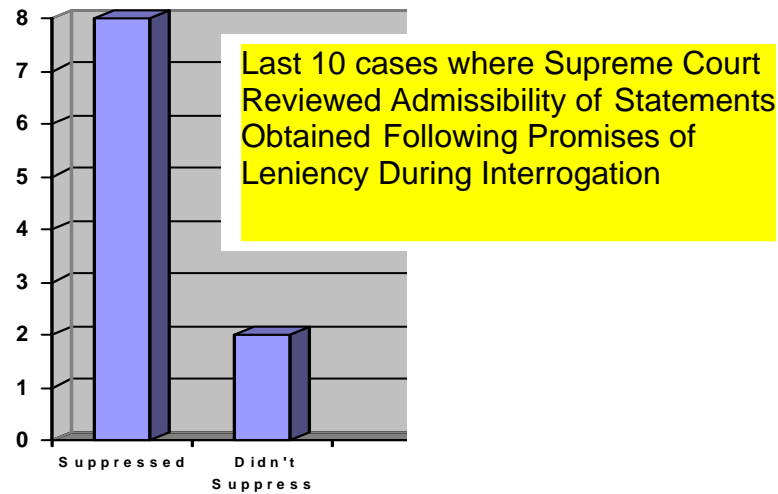


iii. You can create birds-eye line of sight diagrams:



III. YOU CAN CREATE INTERESTING **GRAPHICS IN YOUR WORD PROCESSING PROGRAM.**

- A. Use **TABLES AND CHARTS** to Illustrate Legal Issues or Inconsistent Testimony
- i. For example, when the case law is really on your side, illustrate the point graphically with a chart.



- B. Show Inconsistent Statements by making charts or with text boxes:

LAUREN GILBERT'S STATEMENTS

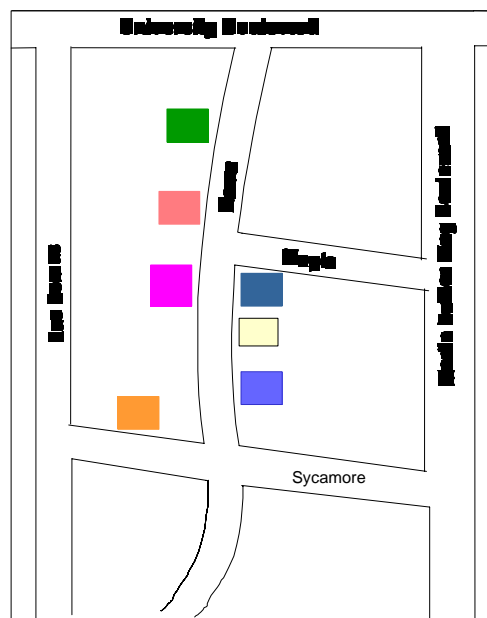
8/19/96 <u>APD Taped</u> No guns	9/96 <u>APD Taped</u> No guns	12/96 <u>Ortiz-Not Taped</u> Saw an object that looked like a gun
---	--	--

- C. Consolidate Voluminous Information with **Tables**:

SUMMARY OF PRIOR CRIME AT 1510 ROMA AND PIMA COUNTY INCIDENT

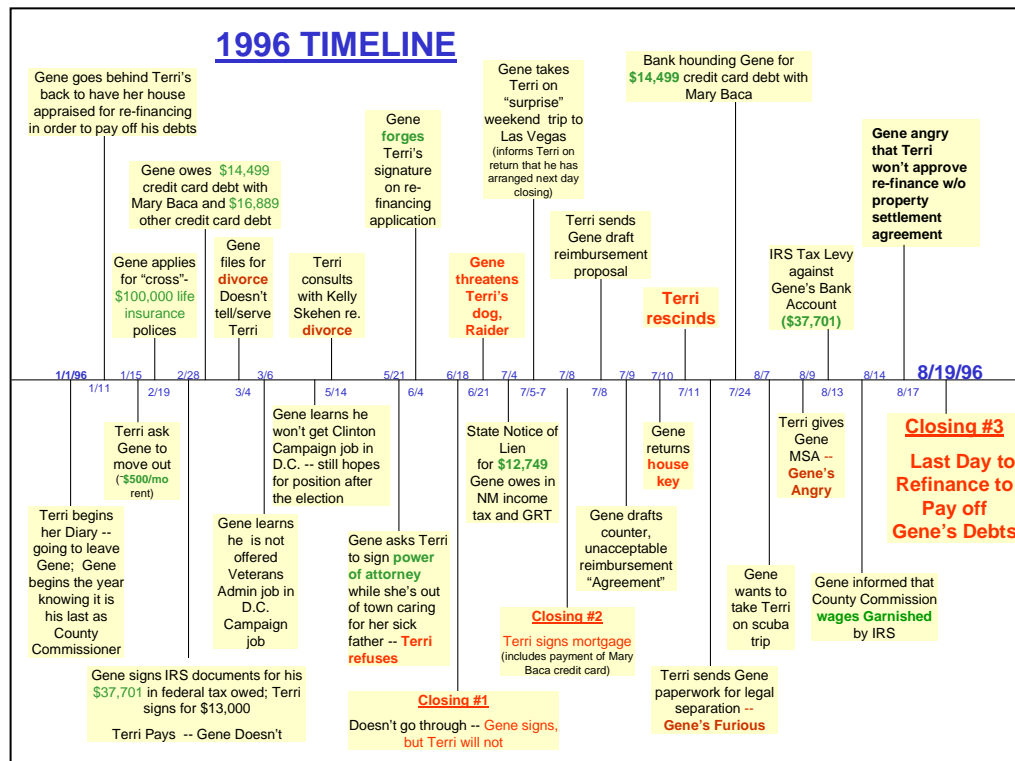
DATE	LOCATION	SUMMARY	INDIVIDUAL REPORTING
3/25/85	1510 Roma	Residential Burglary ; offender forcibly entered rear sliding glass door and stole items	Marilyn Odeneal
4/16/85	1510 Roma	Residential Burglary ; offender forcibly entered residence and stole items	Eugene Gilbert
7/2/85	1510 Roma	Auto Burglary ; Eugene called on behalf of his mother in law, car broken into and radio stolen	Eugene Gilbert
8/28/87	1510 Roma	Auto Burglary ; offender broke car window and stole items	Terri Gilbert
1/30/88	1510 Roma	Criminal Damage ; offender broke windshield of car	Terri Gilbert
3/14/89	1510 Roma	Auto Burglary ; offender stole items from car	Jimmie Ellison
10/31/89	Hotel; Pima County Arizona	Armed Robbery ; offender forced Terri Gilbert into her hotel room and took her jewelry and other items, made her lie face down on the bed, and escaped through the sliding glass door	Terri Gilbert
12/16/89	1510 Roma	Criminal Damage ; offender broke house window and left a threatening note	Terri Gilbert
12/10/92	1510 Roma	Larceny over \$2,500 ; offender entered residence and stole items	Terri Gilbert
10/95	1510 Roma	Intruder Break-In ; Lauren Gilbert wakes in middle of night to find intruder standing over her bed	Lauren Gilbert

- D. Make **maps and diagrams** with your word processing drawing tools.
- i. you can "animate" your boxes in powerpoint.



CRIME IN TERRI'S NEIGHBORHOOD

E. Demonstrate the Development of Facts Over Time with a **Timeline**.



IV. USING PHOTOGRAPHS AND OTHER DOCUMENTS.

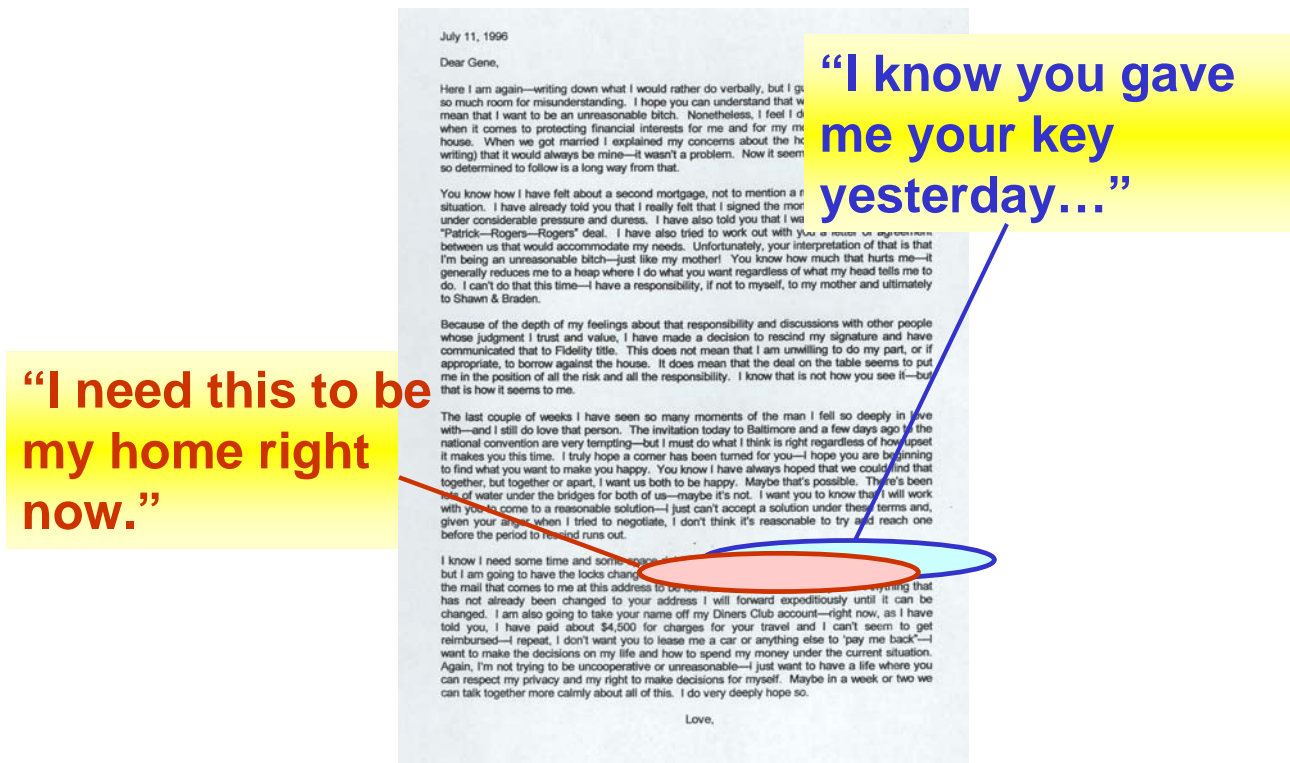
- A. Generally speaking, to work with photographs or manipulate images on your computer you will need:
 - i. scanner or digital camera
 - ii. mid-level graphics program like Microsoft PhotoDraw, CorelDraw, AdobePhotoshop, Painter, etc.
- B. Example: When the only photos you have are from the evidence room, and all the photos have evidence tags or other corrupting markings on them, scan in the photo and remove the markings to create a picture of the original evidence. We did this in order to be able to create a usable **gun array** which was used to establish that the weapon in question was not associated with our client, but with another person.

GUN ARRAY

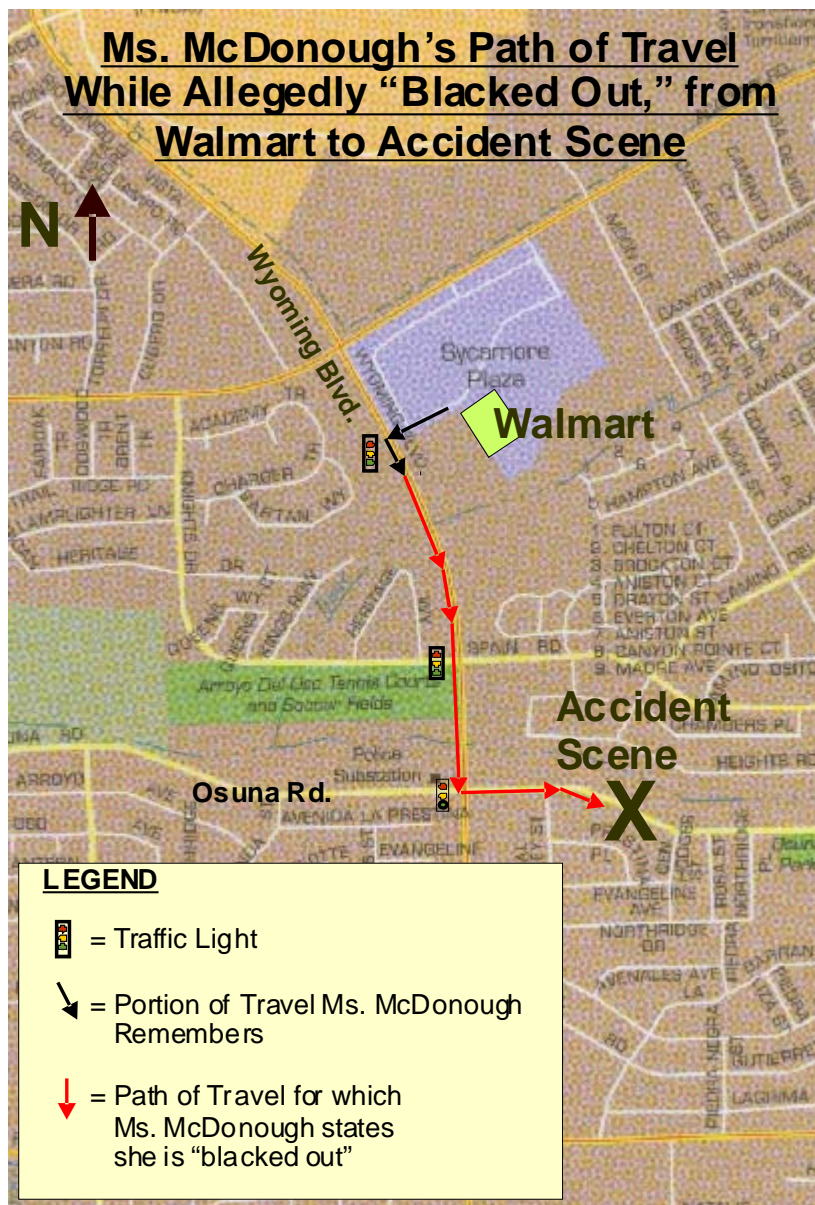


- C. Dramatically Highlight Text Out of Important Documents.
- i. Scan in the Document and use the drawing tools in your word processor to create text boxes to highlight the portions of the Document that are important for the Jury to Notice and Remember.
- a. "animate" these boxes in powerpoint.

Terri's July 11, 1996 letter to Gene



- D. Scan in Maps and Draw on Them to Orient your Jury; Demonstrate Distances or Inconsistencies.



II. MISCELLANEOUS ADVICE

You should plan in advance how you wish to submit exhibits to the jury. If you hand one juror the original of an exhibit, he/she will read through it and not listen to the rest of your direct or cross examination. There are several ways around this dilemma:

1. Provide twelve copies of the exhibit or twelve tabbed folders of all exhibits for the jury to refer to during the course of the trial.
2. Blow up an exhibit to poster size and highlight the important parts of the exhibit.
3. Use your computer (connected to televisions screens or through a projector), a DOAR visual presenter or an overhead projector so you can control what is before the jury and direct attention to important parts of an exhibit. You can use software such as Microsoft Power Point (already on your computer if you have Microsoft Office 2000 or 98) or AC/DC (available off the internet) for presenting photographs and slides.
4. Demonstrative evidence may or may not be admitted into evidence, depending on the particular judge and courtroom in which you are practicing. Push to have the exhibit go to the jury. Your argument should be that if the demonstrative aid has assisted the jury in understanding the testimony in the courtroom, it would also assist the jury in its deliberations in the jury room.

CHAPTER VI:

CRAWFORD V. WASHINGTON:
THE CONFRONTATION CLAUSE
AND STATE HEARSAY LAW

By

John G. Douglass

CRAWFORD V. WASHINGTON: THE CONFRONTATION CLAUSE AND STATE HEARSAY LAW

John G. Douglass
Professor of Law
University of Richmond

I. THE CONFRONTATION-HEARSAY WORLD BEFORE *CRAWFORD*

A. The Sixth Amendment's Confrontation Clause - "In all criminal prosecutions, the accused shall enjoy the right . . . to be confronted with the witnesses against him . . ."

1. Scope of right - The confrontation right applies "in all criminal prosecutions." Clearly that includes trial. The right probably does not extend to sentencing hearings, even in capital cases. *See Williams v. New York*, 337 U.S. 241 (1949); *but cf. Gardner v. Florida*, 430 U.S. 349 (1977) (Due Process Clause violated where court imposed death sentence based on information which defendant had no opportunity to deny or explain).

2. Limits only the Prosecution - The right of confrontation protects the "accused" and therefore imposes limits on hearsay only when offered by the prosecutor.

3. In Addition to the Hearsay Rule - When hearsay is offered by the prosecution, the court should first address its admissibility under the hearsay rules and exceptions. Confrontation is a separate matter that need not be addressed until the court determines that the hearsay is admissible under the law of evidence.

B. The Confrontation-Hearsay Dilemma -

When a witness testifies at trial, the Confrontation Clause guarantees defendant a right:

- to be present, *Kentucky v. Stincer*, 482 U.S. 730, 739-40 (1987);
- to see, hear and be seen by prosecution witnesses (with limited exceptions for, e.g., child witnesses), *Maryland v. Craig*, 497 U.S. 836, 846-47 (1990);

-to an adequate opportunity to cross-examine, *Olden v. Kentucky*, 488 U.S. 227, 231-33 (1988); *Davis v. Alaska*, 415 U.S. 308, 316-18 (1974).

But when the prosecution offers hearsay, the “witness against” the defendant is a hearsay declarant who, typically, does not testify and is not seen, heard or cross-examined by defendant. [At least, until *Crawford*, the Supreme Court insisted that the hearsay declarant was a “witness against” the accused within the meaning of the Confrontation Clause. See *White v. Illinois*, 502 U.S. 346, 352-53 (1992)(rejecting Justice Department claim that only declarants who provide formal “testimonial” statements are “witnesses against” the accused).]

So, on the surface, it appears that the confrontation right is always at odds with hearsay. Yet, both before and after ratification of the Sixth Amendment, American courts admitted various forms of hearsay.

C. *Ohio v. Roberts*: Resolving the Dilemma by Admitting “Reliable” Hearsay

1. The Court’s “General Approach” to Confrontation and Hearsay – In *Ohio v. Roberts*, 448 U.S. 56 (1980), the Court designed a “general approach” to the hearsay-confrontation dilemma. The Court reasoned that the “underlying purpose” of confrontation was to “augment accuracy in the factfinding process.” Since “accuracy” was the goal, the Court found that “trustworthy” hearsay could be admitted without “material departure from the reason of the general rule.” To define “trustworthy” hearsay, the Court looked first to the law of evidence, finding that “certain hearsay exceptions rest upon such solid foundations” that evidence falling within them is reliable enough to satisfy the purposes of confrontation. The Court then summed up its “general approach” to hearsay under the Confrontation Clause:

“[Hearsay] is admissible only if it bears adequate ‘indicia of reliability.’ Reliability can be inferred without more in a case where the evidence falls within a firmly rooted hearsay exception. In other cases, the evidence must be excluded, at least absent a showing of particularized guarantees of trustworthiness.” 448 U.S. at 66.

2. Three Steps for Admitting Hearsay – Under *Roberts*, a trial court followed a three-step analysis in admitting prosecution hearsay:

1. Determine whether the hearsay is admissible under some exception to the hearsay rule;
2. If that exception is “firmly rooted” (see below), then the hearsay is admissible under the Confrontation Clause;
3. If that hearsay exception is not “firmly rooted,” the Confrontation Clause excludes the hearsay, unless the court finds some “particularized guarantees of trustworthiness” in the circumstances surrounding the hearsay statement.

3. The Lake Wobegone Theory of Firmly-Rooted Hearsay Exceptions – *Roberts* turned out to be relatively easy to administer, because courts ultimately found that virtually all recognizable hearsay exceptions were “firmly rooted.” This process effectively “merged” the confrontation question into the law of evidence in the vast majority of criminal cases.

- co-conspirator statements, *Bourjaily v. United States*, 483 U.S. 171, 183 (1987);
- spontaneous declarations, *White v. Illinois*, 502 U.S. 346, 355 n.8 (1992);
- statements for purposes of medical diagnosis, *White*, 502 U.S. at 355 n.8;
- public records, *Ohio v. Roberts*, 448 U.S. at 66 n.8 (dictum);
- business records, *Ohio v. Roberts*, 448 U.S. at 66 n.8 (dictum);
- dying declarations, *Ohio v. Roberts*, 448 U.S. at 66 n.8 (dictum);
- prior testimony, *Ohio v. Roberts*, 448 U.S. at 66 n.8 (dictum);
- recorded recollection, *Hatch v. Oklahoma*, 58 F.3d 1447, 1467 (10th Cir. 1995);
- statements regarding declarant’s state of mind, *United States v. Veltrmann*, 6 F.3d 1483, 1493-94 (11th Cir. 1993);
- statements by an agent, *United States v. Saks*, 964 F.2d 1514, 1525 (5th Cir 1992);
- *res gestae* exception, *Williams v. Melton*, 733 F.2d 1492, 1495 (11th Cir. 1984).

4. Post-*Roberts* Problems – Two types of hearsay continued to pose confrontation problems after *Roberts*:

(a) Residual or “Catch-all” Exception - The Court ruled that the “residual” or “catch-all” hearsay exception was not “firmly rooted.” *Idaho v. Wright*, 497 U.S. 805, 817-18 (1990). Nevertheless, many lower courts have found “particularized guarantees of trustworthiness” and admitted “residual” hearsay over Confrontation Clause objections. See, e.g., *United States v. Earles*, 113 F.3d 796, 800-01 (8th Cir. 1997)(admitting grand jury testimony of unavailable witness under residual exception and finding particularized guarantees of trustworthiness because statement was under oath, never recanted, based on personal knowledge, and not contradicted by extrinsic evidence). See also cases collected at John G. Douglass, *Beyond Admissibility: Real Confrontation, Virtual Cross-Examination, and the Right to Confront Hearsay*, 67 Geo. Wash. L. Rev. 191, 217 nn. 142-43 (1999).

(b) Statements against Interest by Accomplices – Twice, the Court has ruled that hearsay from a non-testifying accomplice, admitted under the hearsay exception for statements against penal interest, violated the Confrontation Clause. *Lilly v. Virginia*, 527 U.S. 116 (1999); *Lee v. Illinois*, 476 U.S. 530 (1986). See generally, John G. Douglass, *Confronting the Reluctant Accomplice*, 101 Columbia L. Rev. 1797 (2001).

II. CRAWFORD V. WASHINGTON: THE NEW WORLD OF CONFRONTATION AND HEARSAY

A. Crawford’s Facts - Crawford was charged with assault and attempted murder in the stabbing of a man who allegedly tried to rape his wife, Sylvia. He claimed self-defense. Because of a state marital privilege (which Crawford invoked), Sylvia did not testify at trial. Instead, the prosecution played a tape-recording of a statement that Sylvia made while in police custody. The statement arguably contradicted Crawford’s self-defense claims. The trial court admitted the recording under the hearsay exception for statements against interest, since Sylvia herself was a suspect at the time of the interrogation and she admitted that she led her husband to the victim’s apartment.

Crawford objected on confrontation grounds. Applying the *Roberts* formula, the trial court found “particularized guarantees of trustworthiness” and admitted the statement.

B. Crawford’s Rationale -

1. History and Text - The Court’s ruling rests almost entirely on a reading of English history (featuring none other than Sir Walter Raleigh) and on the Framers’ reaction to that history. Writing for a majority of seven, Justice Scalia drew two conclusions from history.

First, he noted that the “principal evil at which the Confrontation Clause was directed was the civil-law mode of criminal procedure, and particularly its use of *ex parte* examinations as evidence against the accused.” Sir Walter Raleigh’s prosecution for treason rested heavily on statements obtained through *ex parte* examination of Lord Cobham, despite Raleigh’s protests to “let Cobham be here, let him speak it. Call my accuser before my face . . .” In a similar fashion, under statutes enacted in Queen Mary’s reign in the 16th century, justices of the peace (JPs) conducted *ex parte* examinations during bail and committal proceedings, then reported the witnesses’ statements which came to be used as evidence at trial, despite the absence of the witnesses. Relying on evidence of popular resentment in both England and the American colonies aimed at such “civil-law” procedures, Justice Scalia argued in *Crawford* that the “core concern” of the Confrontation Clause is not hearsay generally, but a narrower class of “testimonial” statements like those produced through *ex parte* examinations in the civil-law mode. The Sixth Amendment text, which applies to “witnesses against” an accused, reflects this focus on formal “testimonial” statements.

Second, Justice Scalia concluded that history called for a categorical ban on “testimonial” hearsay in the absence of an opportunity for confrontation: “The Framers would not have allowed admission of testimonial statements of a witness who did not appear at trial unless he was unavailable to testify, and the defendant had had a prior opportunity for cross-examination.”

On the whole, Justice Scalia suggests, the results of the Court’s earlier confrontation-hearsay cases have been consistent with this “original meaning.” But, he argues, the *Roberts* formula, which allows courts to develop “open-ended” exceptions based on reliability, has no support in that history. *Roberts* is “too broad,” because it applies the Confrontation Clause equally to “testimonial” hearsay and to more casual out-of-court statements. *Roberts* is also “too narrow,” because it does not exclude “testimonial” hearsay categorically, but rather admits some testimonial statements based on a court’s assessment of reliability.

Justice Scalia criticizes the *Roberts* approach as “unpredictable,” because “reliability is an amorphous, if not entirely subjective, concept.”

C. *Crawford’s Holding* - [Here’s my best summary; the Court itself did not offer a summary holding.] In the absence of confrontation, the prosecution’s use of “testimonial” hearsay violates the Sixth Amendment, regardless of the reliability of that hearsay, unless the declarant is unavailable and defendant had a prior opportunity to cross-examine.

III. THE WORLD OF CONFRONTATION AND HEARSAY AFTER *CRAWFORD*

A. *Crawford’s Unanswered Questions* - Though it does not explicitly overrule *Roberts*, *Crawford* severely criticizes, and declines to apply, the *Roberts* “reliability” approach to confrontation and hearsay. Instead, *Crawford* grants almost complete protection to a narrow category of “testimonial” hearsay, while suggesting that other forms of hearsay are not the concern of the Confrontation Clause. *Crawford* leaves us with (at least) three critical questions:

1. What is “testimonial” hearsay? - Unfortunately, the Court doesn’t tell us exactly. But *Crawford* provides some clarity, and some hints:

a. **Prior “formal” testimony:** “Whatever else the term covers, it applies at a minimum to prior testimony at a preliminary hearing, before a grand jury, or at a former trial;....”

b. **Police Interrogation:** Sylvia made her statement in response to custodial police interrogation. And the Court emphasized “Statements taken by police officers in the course of interrogations are also testimonial under even a narrow standard.”

-The term “police interrogation” may be ambiguous. The Court says “We use the term ‘interrogation’ in its colloquial, rather than any technical legal, sense.” Thus, there may be an “interrogation” for Confrontation Clause purposes, but not for *Miranda* purposes. In the wake of *Crawford*, at least one court has held that immediate, informal, on-the-scene questioning by police does not give rise to “testimonial” statements. *Hammond v. State*, 809 N.E.2d 945, 952 (Ind. App. 2004).

-What mattered to the Court is that Sylvia's statement was "knowingly given in response to structured police questioning."

-Sylvia was in custody, but it seems doubtful that custody is the deciding factor.

c. **Three Possible Definitions?** - The Court noted three definitions of "testimonial" statements suggested by other sources, but declined to select among them:

1. "Ex parte in-court testimony or its functional equivalent – that is, material such as affidavits, custodial examinations, prior testimony that the defendant was unable to cross-examine, or similar pretrial statements that declarants would reasonably expect to be used prosecutorially." [from Petitioner Crawford's Brief];
2. "Extrajudicial statements . . . contained in formalized testimonial materials, such as affidavits, depositions, prior testimony, or confessions." [from *White v. Illinois*, 502 U.S. 346, 365 (1992)(Thomas, J., concurring)];
3. "Statements that were made under circumstances which would lead an objective witness reasonably to believe that the statement would be available for use at a later trial." [from amicus brief of NACDL].

Note the difference in the breadth of these definitions. The second (Justice Thomas' view in *White*) is narrowly limited to (a) formal testimony under oath, plus (b) "confessions" (an ambiguous term that may encompass no more than confessions to authorities in response to interrogation). The first and third (both views from the defense bar) extend more broadly to statements a declarant would reasonably expect to become evidence in a prosecution. The Court didn't choose; but in *White*, Justices Scalia and Thomas were skeptical about measuring "testimony" by the declarant's expectations, saying that approach would "entangle the courts in a multitude of

difficulties.” Unless they’ve changed their views, then, at least two members of the Court would favor the narrow definition (#2).

d. What’s NOT “Testimonial” - Examples from the *Crawford* opinion:

- “an offhand, overheard”
- “a casual remark to an acquaintance”
- “business records”
- “statements in furtherance of a conspiracy”

e. Key Factors?

1. Involvement of Government in Eliciting the Statement – The “structured questioning” of police interrogation seemed to matter in *Crawford*. And at least one of the historical concerns in Sir Walter Raleigh’s case was that Lord Cobham’s confession was shaped by his questioners before the Privy Council. So *Crawford* tells us, “Involvement of government officers in the production of testimony with an eye toward trial presents unique potential for prosecutorial abuse”

2. Intent or Expectations of Declarant – The Sixth Amendment text speaks of the “accused,” and the *Crawford* opinion refers to statements of an “accuser.” Thus, it may matter that a declarant made statements for the purpose of criminal accusation, or expecting that her statements would become evidence. See *United States v. Saget*, 377 F.3d 223, 228 (2d Cir. 2004)(“*Crawford* at least suggests that the determinative factor . . . is the declarant’s awareness or expectation that his or her statements may later be used at trial.”). *Saget* holds that a declarant/accomplice’s statement was not testimonial where it was made to a listener who, unknown to the declarant, was recording the conversation for police.

f. 911 Calls? - Under the *Roberts* approach, 911 calls often proved admissible as “spontaneous declarations” or “excited utterances” fitting within a “firmly rooted” hearsay exception. *Crawford* makes many 911 calls more problematic. Are they “testimonial?” 911 call are generated by the caller, not initiated by police. They often

involve some police questioning, though not in custody, not typically “structured” as in *Crawford*, and not necessarily for purposes of investigating crime. Callers sometimes do, and sometimes don’t, contemplate that their statements will become evidence in a criminal case.

- *People v. Moscat*, 777 N.Y.S.2d 875 (N.Y. Crim. Ct. March 25, 2004), 2004 WL 615113 (concluding 911 call made by victim in domestic assault case not “testimonial” because initiated by victim for purpose of seeking aid). *Moscat* says a 911 call “is the electronically augmented equivalent of a loud cry for help.”

- *People v. Cortes*, — N.Y.S.2d —, 2004 WL 1258018 (N.Y. Sup. Ct. May 26, 2004)(finding 911 call from witness reporting a shooting in progress was “testimonial” because witness responded to police questioning which amounts to “interrogation” under *Crawford*). After a lengthy exploration of history, the *Cortes* opinion states, “The 911 call reporting a crime preserved on tape is the modern equivalent, made possible by technology, to the depositions taken by magistrates or JPs under the Marian committal statute.”

g. Children and Domestic Assault Victims Describing Abuse -

Under *Roberts*, statements from children to family members, doctors or even police often were admissible under hearsay law as “spontaneous declarations” or “statements for purposes of medical diagnosis,” and thus admissible under the Confrontation Clause since they fit within a “firmly rooted” hearsay exception. Compare *White v. Illinois*, 502 U.S. 346 (1992)(admitting statements which fell within traditional hearsay exceptions), with *Idaho v. Wright*, 497 U.S. 805 (1990)(excluding statements on confrontation grounds where trial court admitted hearsay under “residual” exception). After *Crawford*, such statements are admissible only if not “testimonial.” Trial courts are splitting on that issue:

- *State v. Vaught*, 682 N.W.2d 284 (Neb. 2004)(admitting child’s statements to doctor where only purpose of examination was medical treatment and “no indication of a purpose to develop testimony for trial”).

- *Commonwealth v. Heard*, 2004 WL 13671163 (Ky. Ct. App.

June 18, 2004)(admitting domestic assault victim’s statement to doctor while excluding victim’s statement to police as “testimonial”)

-People v. Virgil, 2004 WL 1352647 (Colo. Ct. App. June 17, 2004). In *Virgil*, a father walked in as defendant was assaulting his son. After defendant fled, the child described the sexual assault to the father, who then called police. Later the child made statements to a doctor who was a member of a child protection team performing a forensic sexual assault examination. The court found statements to the father not testimonial. But the statements to the doctor, the court found, were made under circumstances where a reasonable witness would believe they were to be used for prosecution.

Query: If the child-victim’s “reasonable expectation” that his statements will be used as evidence makes a statement “testimonial,” then presumably we must consider that “expectation” from the perspective of the reasonable four or six-year-old.

2. When may testimonial hearsay be admitted?

- a. NOT based on Reliability - *Crawford* clearly tells us that “testimonial” hearsay will not be admissible merely because it is “reliable” under the *Roberts* formula.
- b. Testifying Declarant - There is no violation of the Confrontation Clause where the hearsay declarant is present and testifying to her own earlier out-of-court statement, because she is subject to confrontation. In this respect, *Crawford* simply reaffirms *United States v. Owens*, 484 U.S. 554 (1988).
- c. Unavailable Declarant - Prior Opportunity to Cross-examine - The key question remains the same as under pre-*Crawford* cases: Did defendant have an adequate opportunity to cross-examine at some earlier proceeding.

d. Forfeiture by Wrongdoing - *Crawford* notes that defendant can forfeit the confrontation right where his own wrongdoing makes the declarant unavailable, as in cases where defendant kills or threatens the declarant.

e. Not Offered for Truth - The confrontation issue does not arise unless the hearsay statement is offered for its truth. (Multipurpose statements can cause problems. Limiting instructions may not be constitutionally adequate. See *Bruton v. United States*, 391 U.S. 123 (1968).)

f. Dying Declarations?? - *Crawford* notes that practice at the time of the Constitution appears to have allowed dying declarations as an “exception” to the confrontation right. But, the Court added, “if this exception must be accepted on historical grounds, it is *sui generis*.”

3. *What, if any, protection does the Confrontation Clause provide in the case of non-testimonial hearsay?*

Since *Crawford* does not explicitly overrule *Roberts*, the prudent course for lower courts may be to continue to apply *Roberts* to cases involving non-testimonial hearsay. Both the First and Second Circuits have followed that approach:

-*Horton v. Allen*, 370 F.3d 75 (1st Cir. 2004) (applying *Roberts* after determining that declarant’s private statements to an acquaintance were not “testimonial”).

-*United States v. McClain*, 377 F.3d 219, 221 n.1 (2d Cir. 2004) (“*Crawford* does not overrule the Court’s pre-existing Confrontation Clause jurisprudence, enunciated in . . . *Roberts* . . . as it applies to nontestimonial statements . . .”)

On the other hand, it seems a bit odd to continue applying the *Roberts* “reliability” formula after *Crawford* says that *Roberts* “departs from . . . historical principles,” and is “amorphous, if not entirely subjective.” Some observers feel *Crawford* explicitly signaled the death of *Roberts* when

Justice Scalia wrote that “an approach that exempted [non-testimonial] statements from Confrontation Clause scrutiny altogether” would be “consistent with the Framers’ design.”